AD-A088 289 ROME AIR DEVELOPMENT CENTER GRIFFISS AFB NY F/G 5/1
INDUSTRY LOOKS AT RADC - 1980. VOLUME I.(U)
1980
UNCLASSIFIED RADC-TR-80-195-VOL-1 NL

1 OF 4
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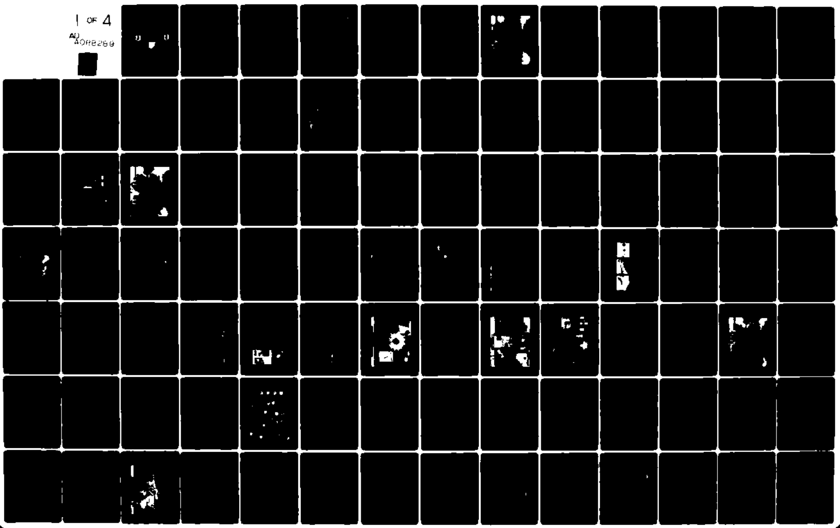

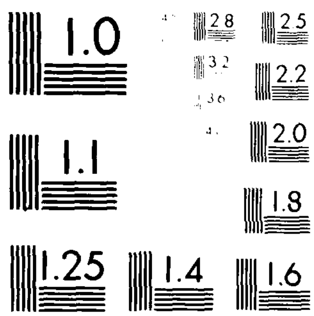

MICROCOPY RESOLUTION TEST CHART

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RADC-TR-80-195, Vol I (of three)
In-House Report
3-4 June 1980

12

LEVEL II

AD A088289

ROME AIR DEVELOPMENT CENTER
(RADC)

INDUSTRY LOOKS AT RADC - 1980

AIR FORCE SYSTEMS COMMAND

ELECTRONIC SYSTEMS DIVISION

ROME AIR DEVELOPMENT CENTER

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ROME AIR DEVELOPMENT CENTER
Air Force Systems Command
Griffiss Air Force Base, New York 13441

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INDUSTRY LOOKS AT RADC - 1980, VOL I

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Because of the size of this document, it has been divided into three volumes. Volume I contains pages 1 - 303, Volume II contains pages 305 - 541, and Volume III contains pages 543 - 791.

RADC-TR-80-195, Volume I (of three) has been reviewed and is approved for publication.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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RADC Program Industry C^3I Planning

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report is a compilation of presentation materials used during the 2-day "Industry Looks at RADC" briefings given on 3 - 4 June 1980. Projected RADC areas of contractual opportunity for FY 81 - 82 are given.

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS ROME AIR DEVELOPMENT CENTER (AFSC)
GRIFFISS AIR FORCE BASE, NEW YORK 13441

RADC COMMANDER'S MESSAGE

THIS SET OF PROCEEDINGS REPRESENTS A SIGNIFICANT EXPANSION OVER OUR PREVIOUS PRESENTATIONS TO INDUSTRY. THE CHANGE TO A TWO DAY FORMAT AND PARALLEL AFTERNOON SESSIONS HAS ENABLED US TO PRESENT MORE DETAIL ON PARTICULAR PROGRAMS WITHOUT NEGLECTING THE LONG TERM DIRECTIONS OF RADC.

IF YOU HAVE SUGGESTIONS OR COMMENTS ON HOW WE CAN IMPROVE THIS UNDERSTANDING WITH INDUSTRY, PLEASE CONTACT US DIRECTLY, OR THROUGH THE QUESTIONNAIRE ENCLOSED WITH THIS COPY.

Donald J. Stukel
DONALD J. STUKEL
Colonel, USAF
Commander

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3 June 1980

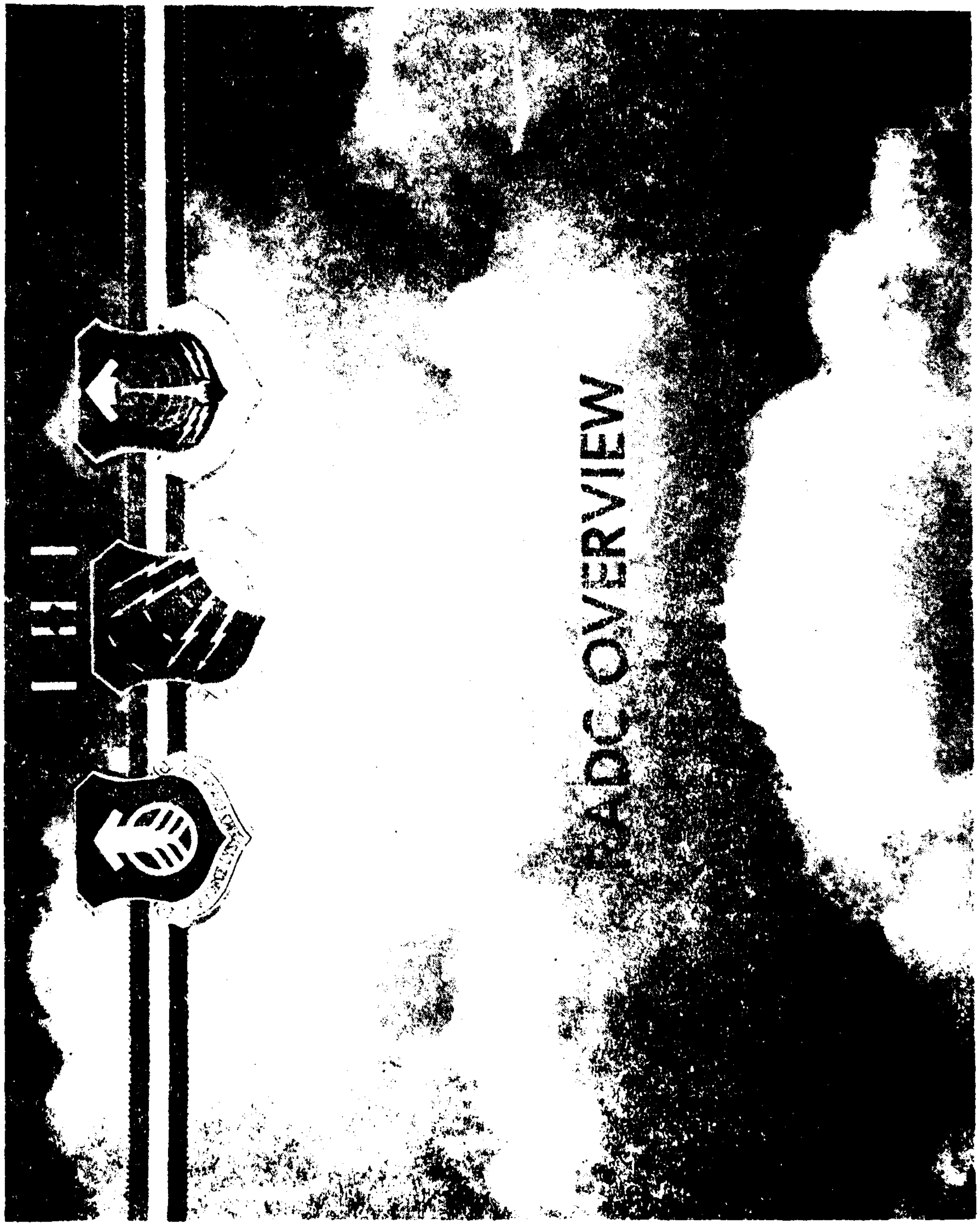
INDUSTRY LOOKS AT RADC

0715	Registration
0800	Welcome -
0805	RADC Overview - Col D. Stukel
0830	Film: AFSC Acquisition Initiative Update - General A. Slay
0900	Surveillance - Lt Col M. Haugen
0945	Communications - Dr. F. Diamond
1030	Break
1045	Electromagnetics - Lt Col W. Baschnagel
1130	Solid State Devices - Mr. B. Buchanan
1215	Lunch
1345 - 1445	Parallel Mini-Sessions
Bldg. 106 Auditorium	Host: OC - Surveillance ECCM - Shields - Aircraft Identification - Wolf
Base Theater	Host: DC - Switching and Routing - Marples - System Control - Spector - Distributed C^3 - Schmitt
Silver Wings	Host: EE - Antennas - McIlvenna
Chapel	Host: ES - System Timing Components - Yannoni
1515 - 1615	Parallel Mini-Sessions
Bldg. 106 Auditorium	Host: OC - Space Based Radar - Simons - Cruise Missile Surveillance - Ogrodnik
Base Theater	Host: DC - Satellite Communications - Lee - Optical Communications - Hendrickson - Sub-UHF Communications - Talty
Silver Wings	Host: EE - RF Components - Carr
Chapel	Host: ES - Electro-Optic Devices - Yang
1900	No Host Social Hour - Beeches Restaurant
2000	AFCEA Dinner
2100	Major General James W. Stansberry DCS, Contracting and Manufacturing AFSC

4 June 1980

INDUSTRY LOOKS AT RADC

0800	RECCE/Intel - Col O. Lawter
0845	Reliability/Maintainability/Compatibility - Mr. J. Bart
0930	Information Processing - Mr. A. Barnum
1015	Break
1030	Contracting Procedures - Lt Col J. Faulkner
1115	Questions & Answers for CC/CV/PK
1145	Lunch
1330 - 1430	Parallel Mini-Sessions
Base Theater	Host: IR - Direct Digital Targeting - Crane - Precision Guidance & Strike Products - Palermo
Chapel	Host: RB - Solid State Device Reliability - Bart
Silver Wings	Host: IS - Information Processing Structures - Metzger - Information Processing Databases - Metzger
Bldg. 106 Auditorium	Host: IS - C^2I Decision Aids - Atkinson - Higher Order Languages - DiNitto
1500 - 1600	Parallel Mini-Sessions
Base Theater	Host: IR - Wideband Recording - Jamberdino - Speech Processing - Beek
Silver Wings	Host: RB - Equipment/System Reliability and Maintainability - Coppola
Bldg. 106 Auditorium	Host: IS - Software Engineering - Bergstrom
Chapel	Host: RB - Electromagnetic Compatibility Analysis and Controls - Capraro/Baustert/Stegmaier


RADC OVERVIEW

RADC MISSION

- PLANS & EXECUTES RESEARCH, EXPLORATORY & ADVANCED DEVELOPMENT IN C^3I ACTIVITIES:
    - COMMUNICATIONS
    - SURVEILLANCE OF GROUND & AEROSPACE OBJECTS
    - INTELLIGENCE DATA COLLECTION & HANDLING
    - INFORMATION SYSTEM TECHNOLOGY
    - ELECTROMAGNETIC PROPAGATION
    - SOLID STATE PHYSICS
    - ELECTRONIC RELIABILITY, MAINTAINABILITY & COMPATIBILITY
- CONDUCTS ASSIGNED ENGINEERING DEVELOPMENTS
- PROVIDES SUPPORT TO TECHNOLOGY INTENSIVE ACQUISITION PROGRAMS
- CONDUCTS SELECTED ACQUISITIONS IN THE INTELLIGENCE AREA

RADC ORGANIZATION

COMMANDER — CHIEF SCIENTIST

STAFF & SUPPORT

- CONTRACTING
- COMPTROLLER
- SUPPORT SERVICES
- INTEGRATED LOGISTICS SUPPORT
- JUDGE ADVOCATE
- STAFF METEOROLOGIST
- SAFETY
- SMALL BUSINESS
- INTELLIGENCE
- OPERATIONS
- PLANS
- SECURITY

MISSION DIVISIONS

- SURVEILLANCE
- COMMUNICATIONS & CONTROL
- INFORMATION SCIENCES
- RELIABILITY & COMPATIBILITY
- INTELLIGENCE & RECONNAISSANC
- SOLID STATE SCIENCES
- ELECTROMAGNETIC SCIENCES

RADC RESOURCES

PEOPLE (AUTHORIZED):

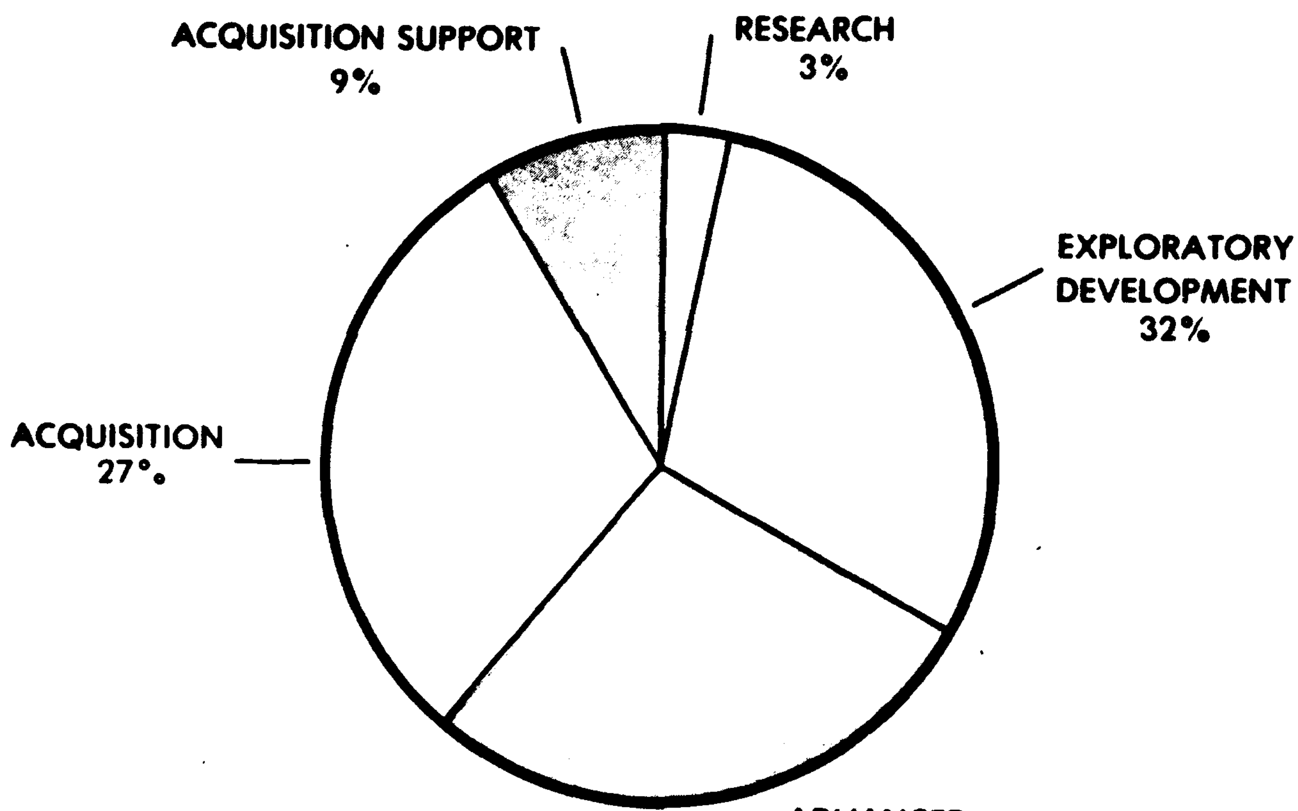
	S&E	TECH	OTHER	TOTAL
OFFICERS	118		24	142
AIRMEN		24	54	78
CIVILIANS	598	163	335	1096
	716	187	413	1316

MONEY:

FY 80 241 MILLION

AS OF: 1 MAY 80

FY-80
RADC PROGRAM SPECTRUM
FUNDS BY TYPE OF WORK



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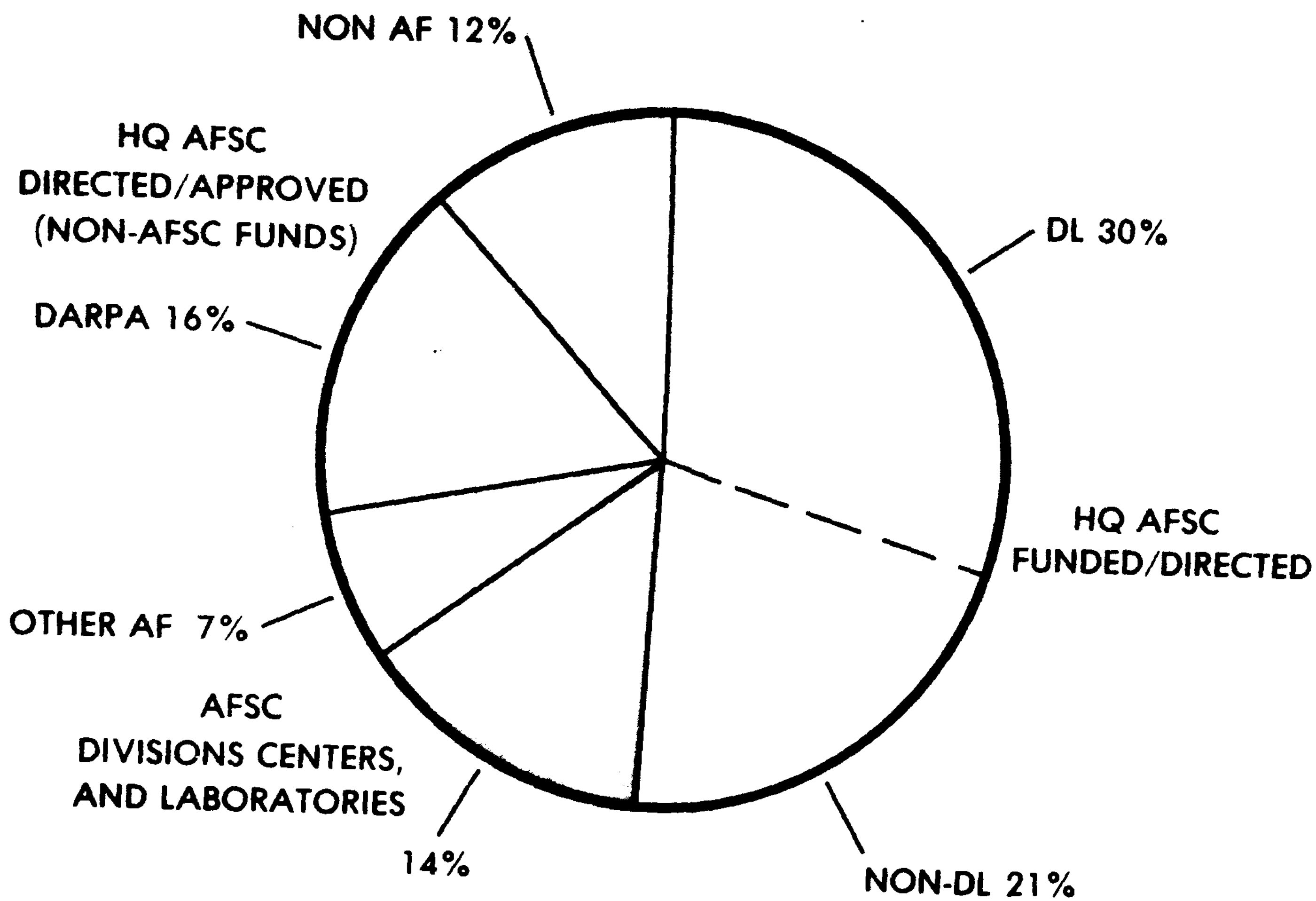
FY-80
SOURCES OF FUNDS



SOURCES OF C^3I TECHNOLOGY

- CONTRACT
  - \$60M
  - RADC INITIATED
- INDEPENDENT RESEARCH & DEVELOPMENT
  - \$400M
  - INDUSTRY INITIATED (55 CORPORATIONS)

PROJECT VANGUARD

- A MAJOR AFSC PLANNING ACTIVITY

RADC USAGE OF VANGUARD

- PROGRAM DIRECTION
- PROGRAM TIMING
- PROGRAM RELATIONSHIPS
- PROGRAM VISIBILITY

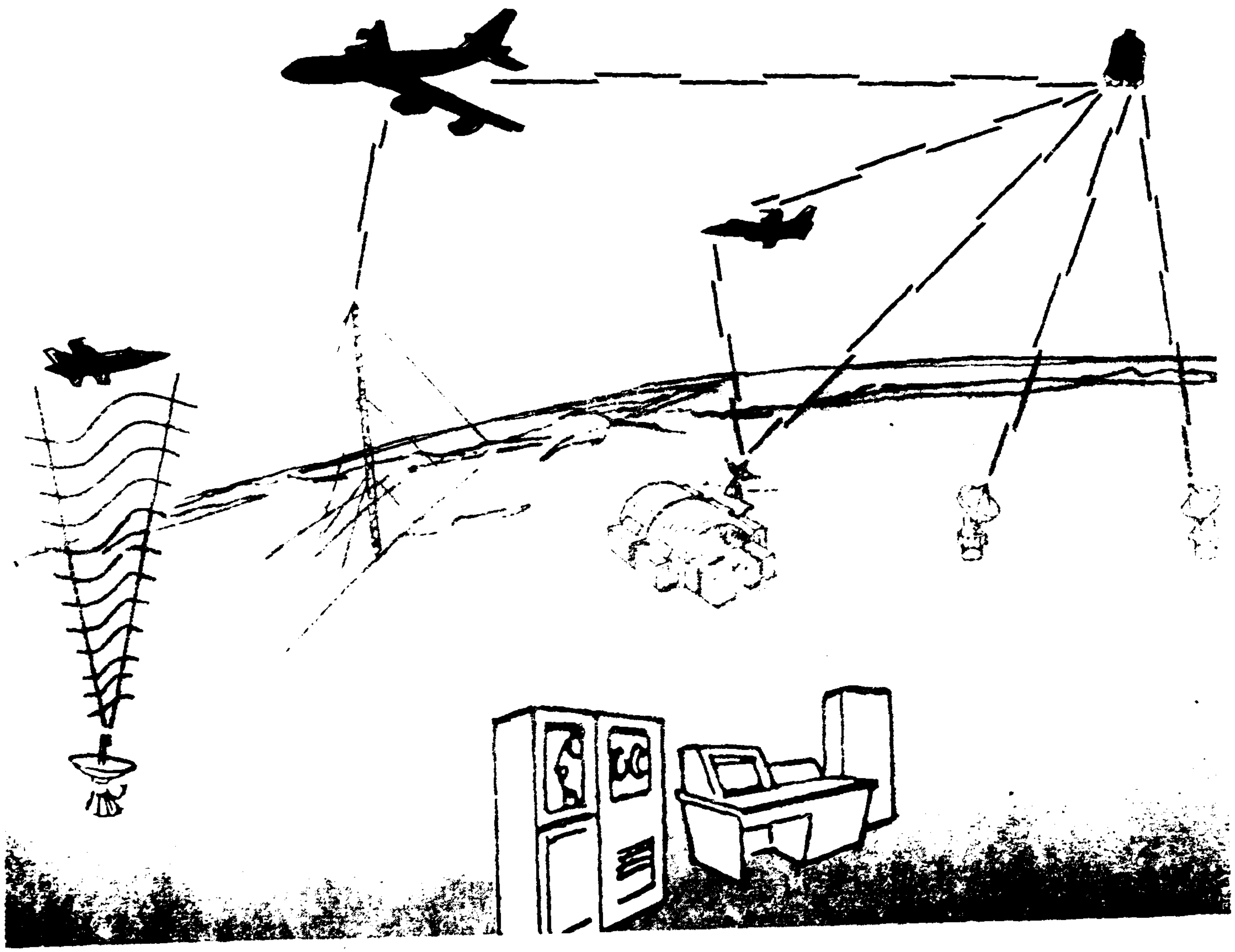
TECHNOLOGY PLANNING OBJECTIVES

1. INDICATIONS & WARNING
   - TECHNICAL INTELLIGENCE
   - SIGNAL INTELLIGENCE
   - SURVEILLANCE SENSOR TECH
   - STRATEGIC TARGET SIGNATURES
   - INTEGRATED INTELLIGENCE SYSTEMS
2. ALL WEATHER SURVEILLANCE & TARGETING
   - EMITTER LOCATION, IDENT & STRIKE
   - ACTIVE TARGET IDENT & LOCATION
   - GROUND TARGET DETECT & IDENT
   - PRECISION TARGETING & CHARTING
   - AIRCRAFT IDENTIFICATION
3. COMM & INFORMATION PROCESSING FOR C^3
   - NETWORK MANAGEMENT & CONTROL
   - INFORMATION TRANSMISSION
   - DISTRIBUTED C^3
   - C^2 INFORMATION PROCESSING
   - C^3 SIMULATION & EXPER
4. C^3 SURVIVABILITY
   - COMMUNICATIONS ECCM
   - SURVEILLANCE ECCM
   - EM COMPATIBILITY
   - EM (DEVICE) RADIATION HARDENING
   - COMMUNICATIONS SECURITY
5. C^3 SYS AVAILABILITY (HARDWARE/SOFTWARE
   - SOFTWARE COST REDUCTION
   - SOLID STATE DEVICE RELIABILITY
   - EQUIPMENT/SYSTEM R&M
   - ADV C^3 ELEC MATERIALS & DEVICES
6. OTHER
   - BISS
   - HAVE NOTE
   - C^3 PROTECTIVE SYS EVALUATION FAC

RADC TECHNOLOGY PLANNING OBJECTIVES
(TPO)

1. COMMND, CONTROL & COMMUNICATIONS
   - A. SUPPORT C^3
   - B. STRATEGIC C^3
   - C. TACTICAL C^3
   - D. C^3CM
2. RECONNAISSANCE/INTELLIGENCE
   - A. SURVEILLANCE
   - B. CORRELATION/FUSION
3. STRATEGIC SYSTEMS
   - A. ATMOS SURV & WARNING
   - B. SPACE SURV & WARNING
4. TECHNOLOGY
   - A. SURVEILLANCE
   - B. COMMUNICATIONS
   - C. ELECTROMAGNETICS
   - D. SOLID STATE DEVICES
   - E. RECONNAISSANCE/INTELLIGENCE
   - F. RELIABILITY/COMPATIBILITY
   - G. INFORMATION PROCESSING
5. SPECIAL PROJECTS
   - A. SYSTEMS/EQUIPMENT EVALUATION
   - B. BISS
   - C. COMPUTER FACILITY
   - D. HAVE NAME

TPO-1 COMMAND, CONTROL & COMMUNICATIONS



TPO 1-COMMAND CONTROL & COMMUNICATIONS

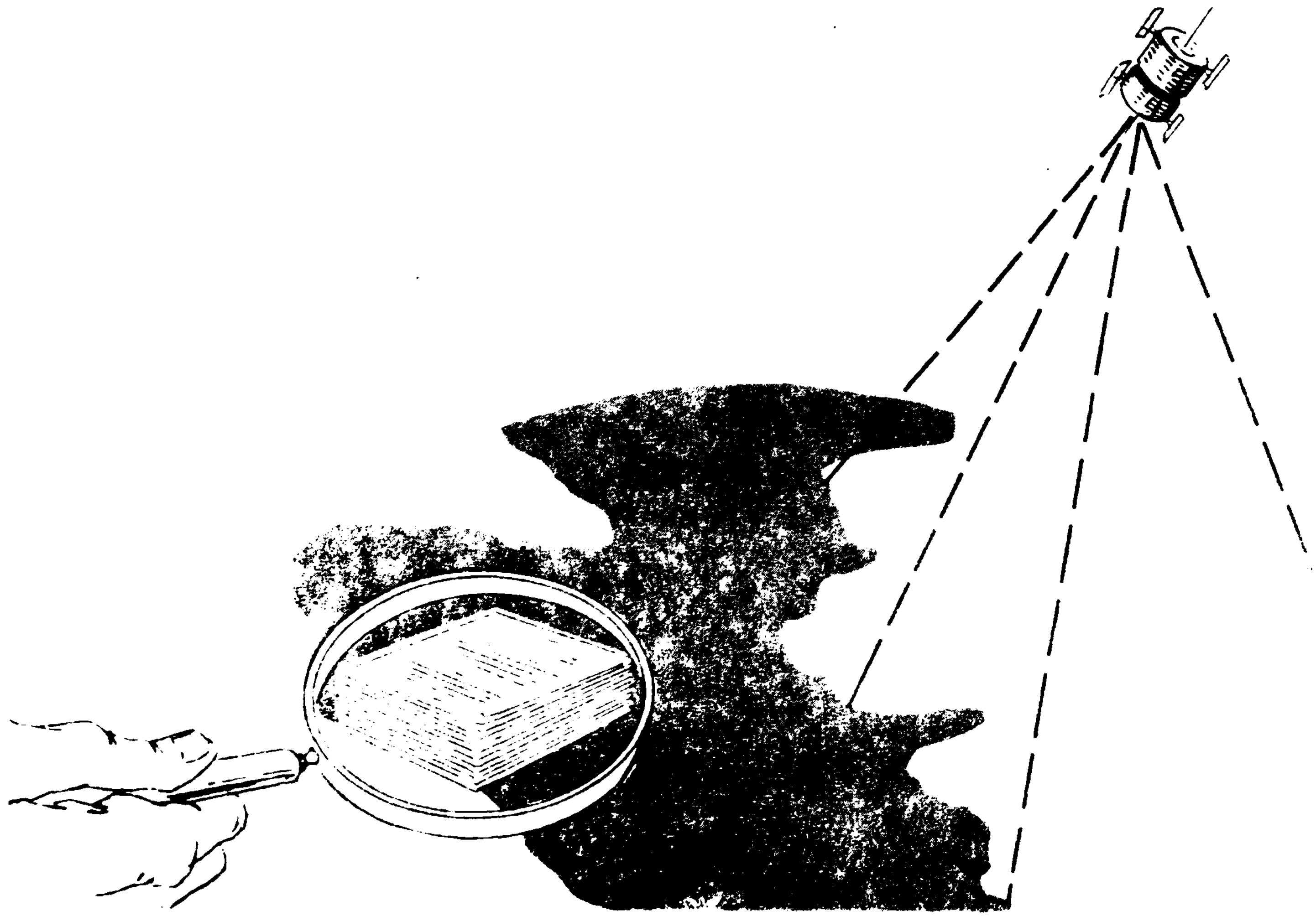
OBJECTIVE:

PROVIDE MEANS FOR COMMANDERS TO PLAN, DIRECT & CONTROL OPERATIONS OF ASSIGNED FORCES

MAJOR TECHNOLOGY THRUSTS:

- SURVIVABLE COMMUNICATION NETWORKS
- JAM RESISTANT COMMUNICATIONS
- REAL TIME AIRCRAFT IDENTIFICATION
- DISTRIBUTED, NETTED SENSORS
- AUTOMATED DECISION AIDS
- PRECISION TARGETING
- INTELLIGENCE PROCESSING & EXPLOITATION
- COMMAND & CONTROL COUNTERMEASURES

TPO 2 - RECONNAISSANCE / INTELLIGENCE



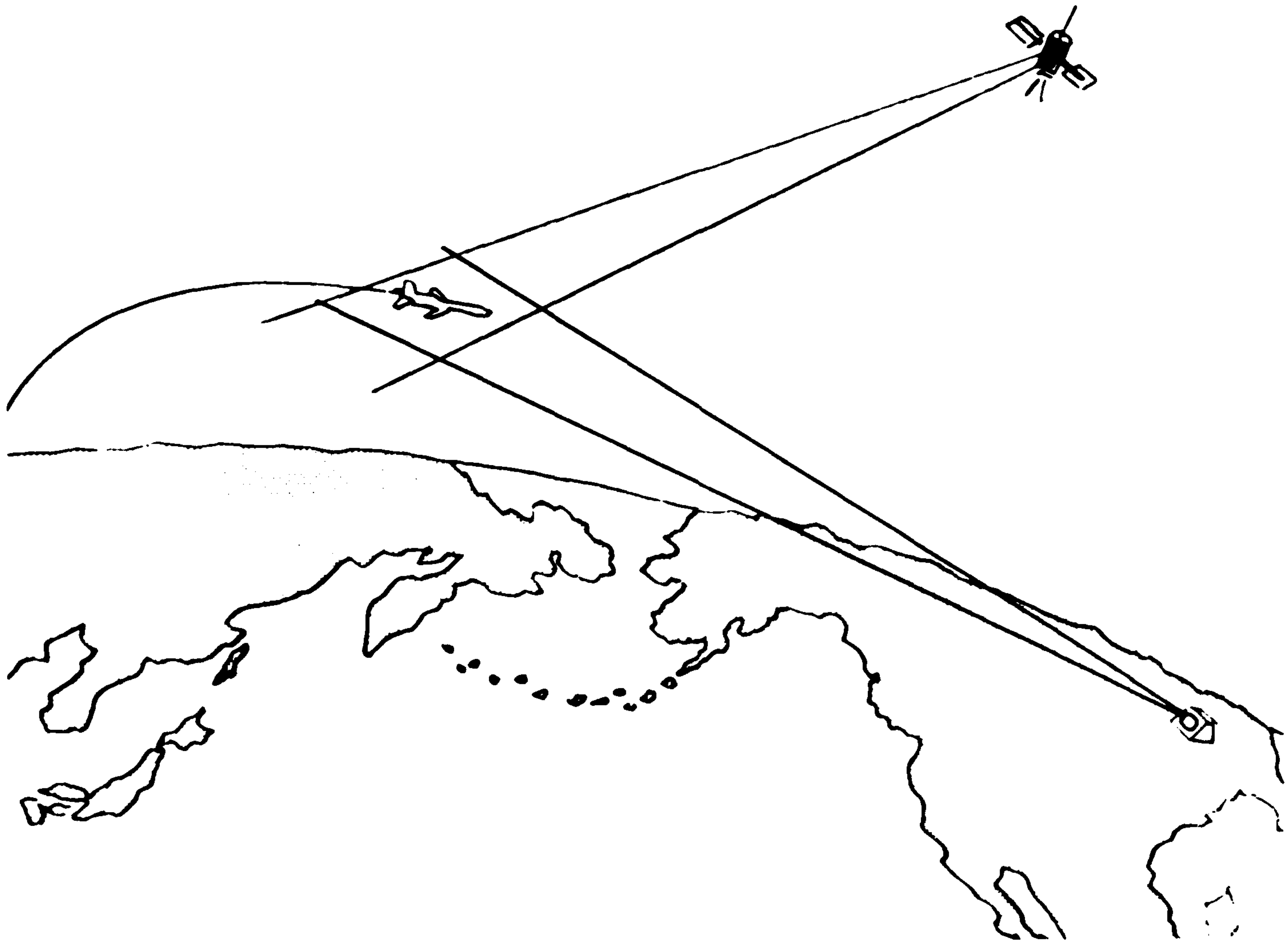
TPO 2 - RECONNAISSANCE/INTELLIGENCE

INTEGRATED INTELLIGENCE PRODUCTS AND PRECISION LOCATION INFORMATION TO SUPPORT A.F. COMMAND, CONTROL AND STRIKE

MAJOR TECHNOLOGY THRUSTS:

- ACTIVE TARGET LOCATION
- INTELLIGENCE DATA CORRELATION/FUSION
- GUIDANCE & STRIKE PRODUCTS FROM IMAGERY EXPLOITATION

TPO 3 - STRATEGIC SYSTEMS



TPO 3-STRATEGIC SYSTEMS

OBJECTIVE:

PROVIDE SURVEILLANCE & WARNING OF BOMBER/MISSILE ATTACK THROUGH SPACE BASED AND ATMOSPHERIC SURVEILLANCE TO ENHANCE EXECUTION CAPABILITY OF U.S. STRATEGIC OFFENSIVE FORCES

MAJOR TECHNOLOGY THRUSTS:

- SPACE BASED RADAR/CRUISE MISSILE SURVEILLANCE
- INTELLIGENCE /SPECIAL RADARS
- ELECTRO-OPTICAL SURVEILLANCE
- DUCTED IONOSPHERIC PROPAGATION

TPO 4-TECHNOLOGY

INFORMATION PROCESSING

SURVEILLANCE

SOLID STATE DEVICES

TECH
BASE

COMMUNICATIONS

RECONNAISSANCE / INTELLIGENCE

ELECTROMAGNETICS

RELIABILITY,
MAINTAINABILITY, & COMPATIBILITY

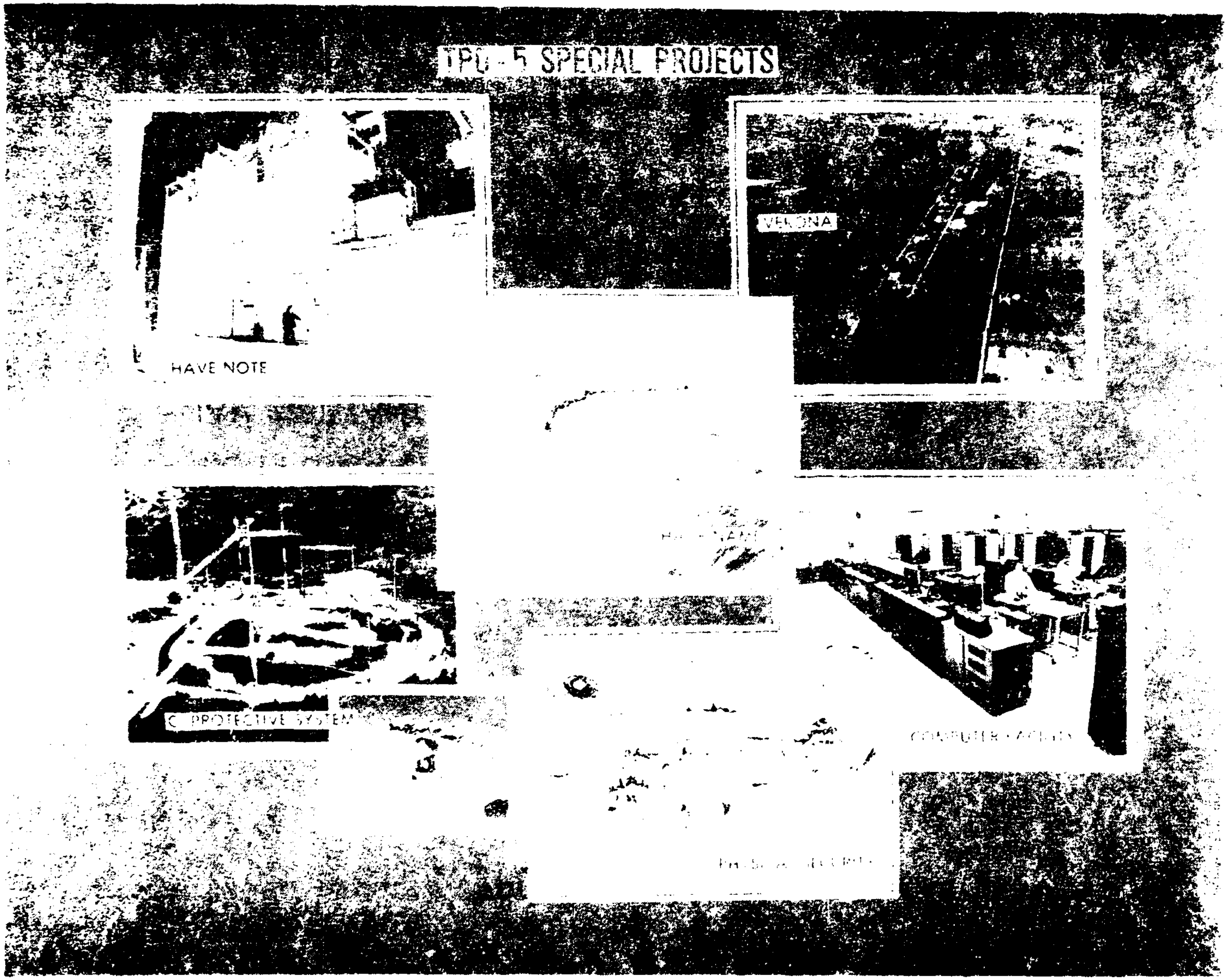
TPO 4-TECHNOLOGY

OBJECTIVE:

TO PROVIDE A BROAD SCIENTIFIC & ENGINEERING FOUNDATION FOR THE DEVELOPMENT OF AIR FORCE C^3I SYSTEMS

MAJOR TECHNOLOGY THRUSTS:

- HIGH POWER MICROWAVE AMPLIFIERS & TRANSMITTERS
- JAM RESISTANT DATA LINKS
- CONFORMAL ANTENNA ARRAYS
- SURVIVABLE SOLID STATE DEVICES
- HIGH DATA RATE DIGITAL RECORDERS
- RELIABILITY, MAINTAINABILITY & COMPATIBILITY ANALYSIS & PREDICTION
- SURVIVABLE & INTEROPERABLE DATA PROCESSING


TPO-5 SPECIAL PROJECTS
HAVE NOTE
PROTECTIVE SYSTEM

TPO 5-SPECIAL PROJECTS

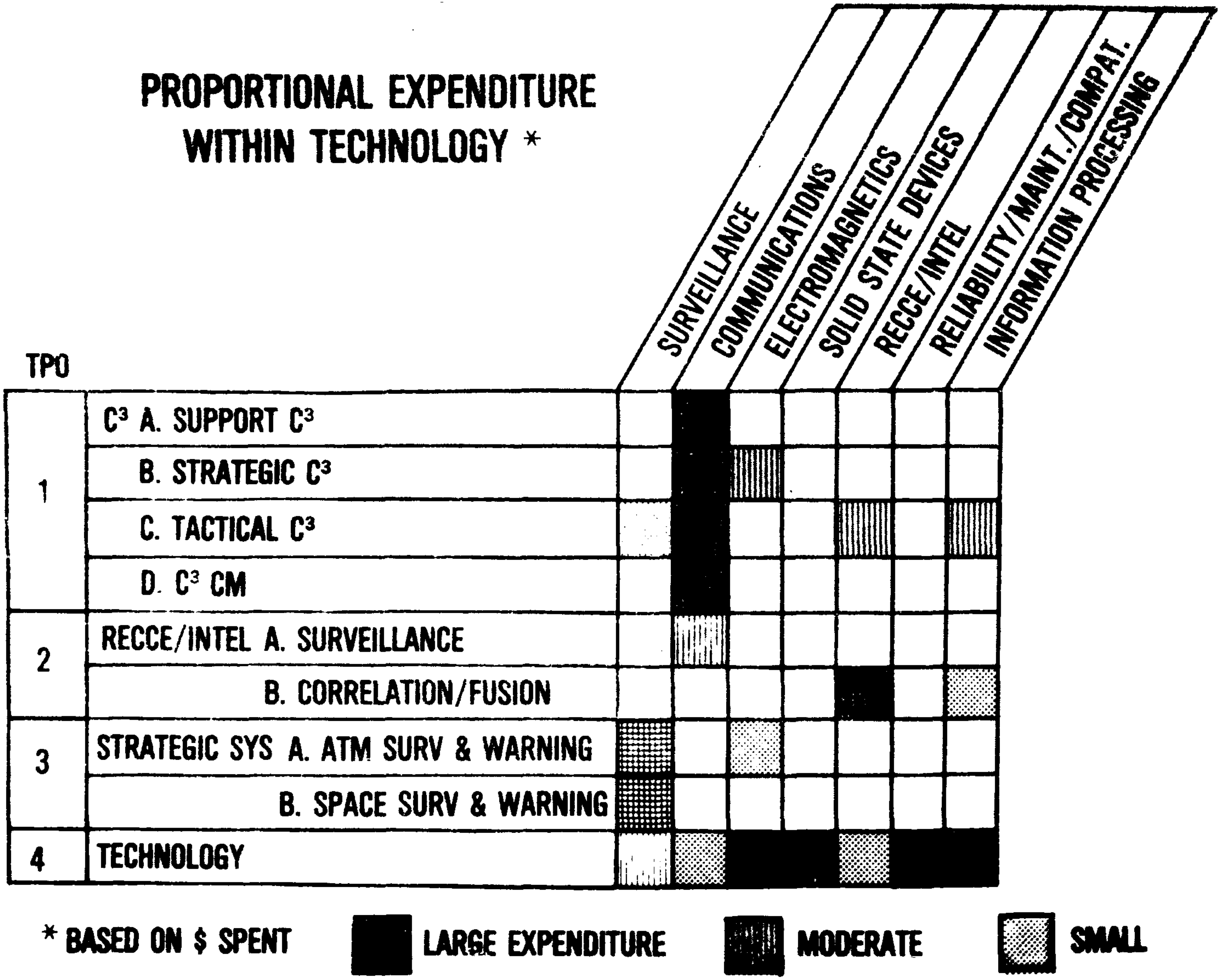
OBJECTIVES:

- DEVELOP METHODOLOGY & DATA ACQUISITION/ANALYSIS FACILITIES ESSENTIAL FOR EVALUATION OF C^3 AND PROTECTIVE SYSTEMS/EQUIPMENT
- PROVIDE SUPPORT TO PROJECTS UNIQUE TO RADC AREAS OF EXPERTISE

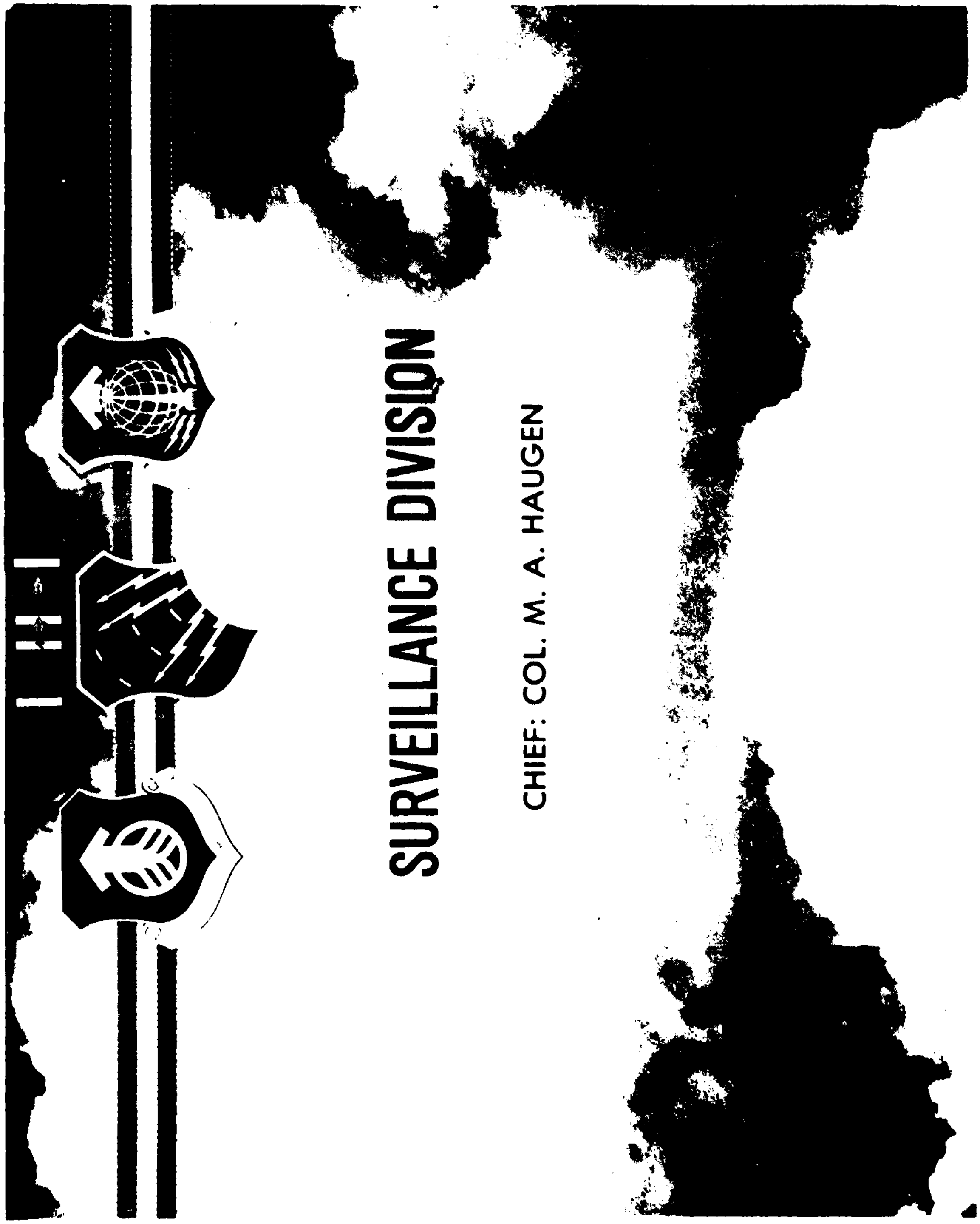
MAJOR TECHNOLOGY THRUSTS:

- TECHNIQUES & SYSTEMS EVALUATION FACILITIES
- PHYSICAL SECURITY
- HAVE NAME

PROPORTIONAL EXPENDITURE WITHIN TECHNOLOGY *



* BASED ON $ SPENT

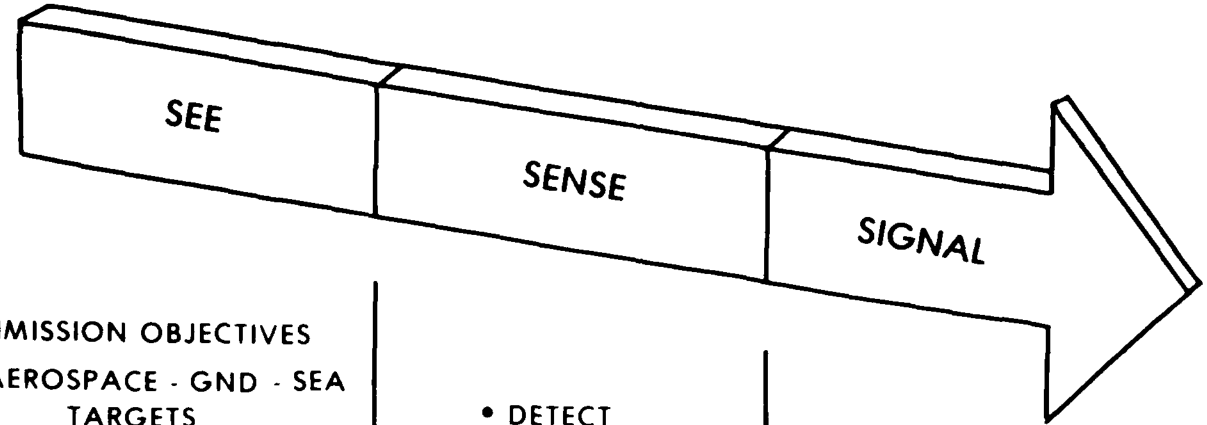

SURVEILLANCE DIVISION
CHIEF: COL. M. A. HAUGEN

DIVISION MISSION

PLAN & CONDUCT RESEARCH, EXPLORATORY & ADVANCED DEVELOPMENT PROGRAMS IN C^3 TECHNICAL FIELDS CONSISTENT WITH OVERALL C^3 TECHNOLOGY NEEDS OF AIR FORCE.

CONDUCT SPECIAL STUDIES & ANALYSIS FOR TACTICAL SURVEILLANCE, STRATEGIC SURVEILLANCE & SURVEILLANCE TECHNOLOGY.

SURVEILLANCE /sŭr-ˋvāl-len(t)s/ n. [F] to watch over



SEE	SENSE	SIGNAL
• MULTIMISSION OBJECTIVES - AEROSPACE - GND - SEA TARGETS • PLATFORM VARIETY - GROUND - AIR - SPACE • MULTIPLE SENSOR TYPES - FULL SPECTRUM	• DETECT • TRACK • DISCRIMINATE • IDENTIFY	PROVIDE TIMELY: • WARNING STRATEGIC/TACTICAL • FORCE MANAGEMENT INFO - ALLOCATION - ENGAGEMENT

SURVEILLANCE DIVISION ACTIVITIES

OUTLINE:

- ADVANCED TACTICAL SURVEILLANCE
  - DETECTION - DISCRIMINATION - BATTLE MGT
- STRATEGIC SURVEILLANCE
  - DETECTION - WARNING
- SURVEILLANCE TECHNOLOGY
  - PROCESSES - THERMIONICS

ADVANCED TACTICAL SURVEILLANCE

KEY/RELATED ELEMENTS

- RADAR INTERNETTING
- ADVANCED AIRBORNE SURVEILLANCE RADAR
- ADVANCED TACTICAL RADAR
- AIRCRAFT IDENTIFICATION

RADAR INTERNETTING

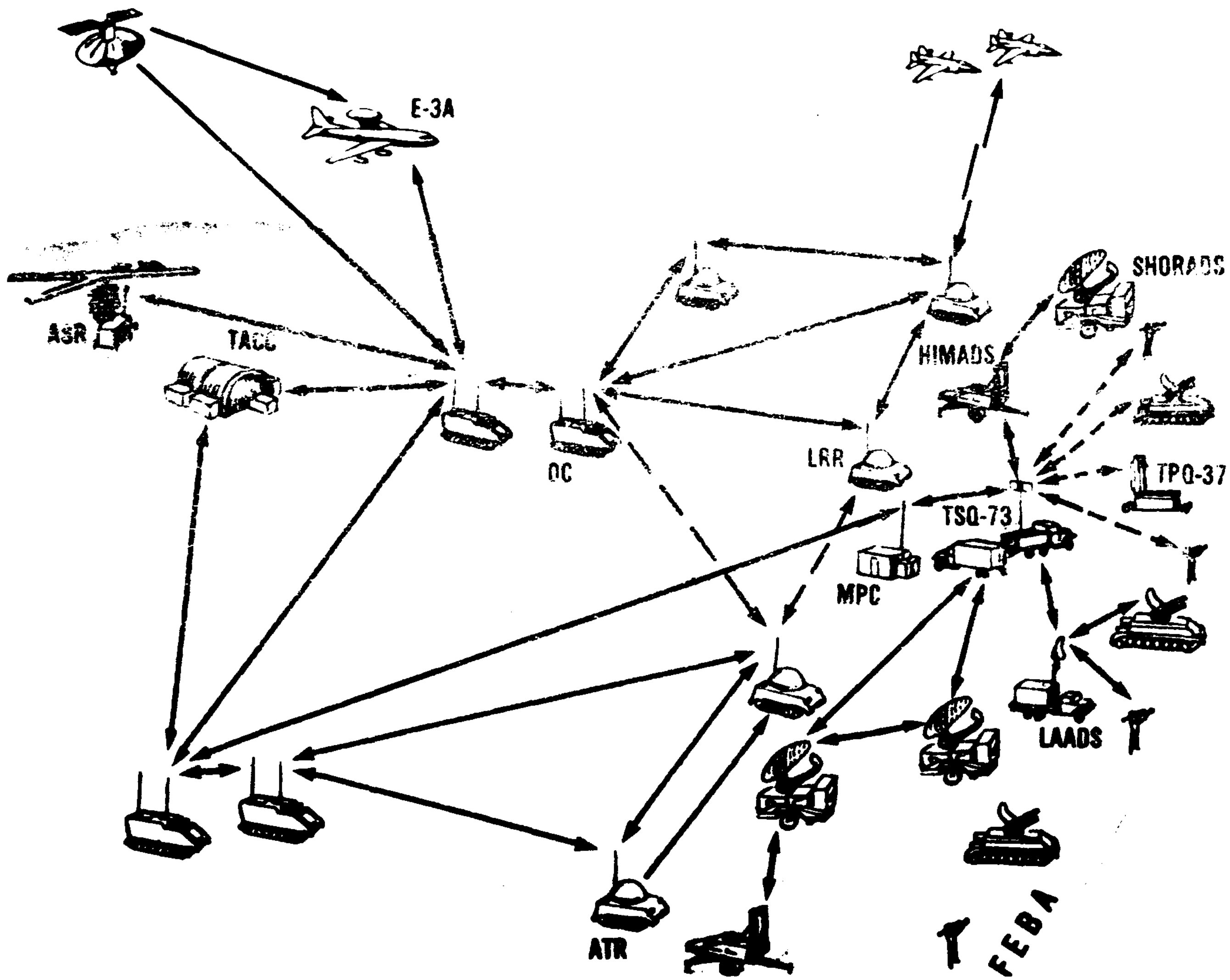
OBJECTIVE: IMPROVED TACTICAL SURVEILLANCE SYSTEM, LOW LEVEL COVERAGE, TARGET HANDLING & SURVIVABILITY

APPROACH: SIMULTANEOUS TRACK OF 1,000 TARGETS
COVERAGE TO 200 FEET AGL
ECCM, ANTI-ARM IMPROVEMENT
6.3 FY 82 - TRANSFER TO SPO FY 88

START DATE/DURATION: FY 82 7 YEARS

FUNDS (TOTAL 6.3): $10M

SURVEILLANCE SYSTEM INTERNETTING



RADAR INTERNETTING

OPTIMIZE SENSOR DATA UTILIZATION

- SIMULATION/EMULATION
- ADAPTIVE PROCESSING
- ADVANCED TRACKING VIA ARRAY PROCESSING
- DATA EXTRACTION

EXPLOIT IMPROVED ID TECHNIQUES

- MULTI-SENSOR TECHNIQUES
- PASSIVE
- ACTIVE

DEVELOP QUADRAPHASE MODEMS

- IMPROVED MESSAGE STANDARDS/ERROR CORRECTION
- DATA HANDLING & TRANSFER TECHNIQUES

IMPROVE SURVIVABILITY

- MODULARITY
- ENERGY MANAGEMENT

ADVANCED AIRBORNE SURVEILLANCE RADAR

OBJECTIVE: ENHANCED CAPABILITY FOR E-3A RADAR:

- SURVIVABILITY FROM ARMs
- UPGRADED AIRCRAFT TRACKING

APPROACH: INVESTIGATIONS IN CRITICAL AREAS FY 82

FABRICATION OF CRITICAL EQUIPMENT FY 83

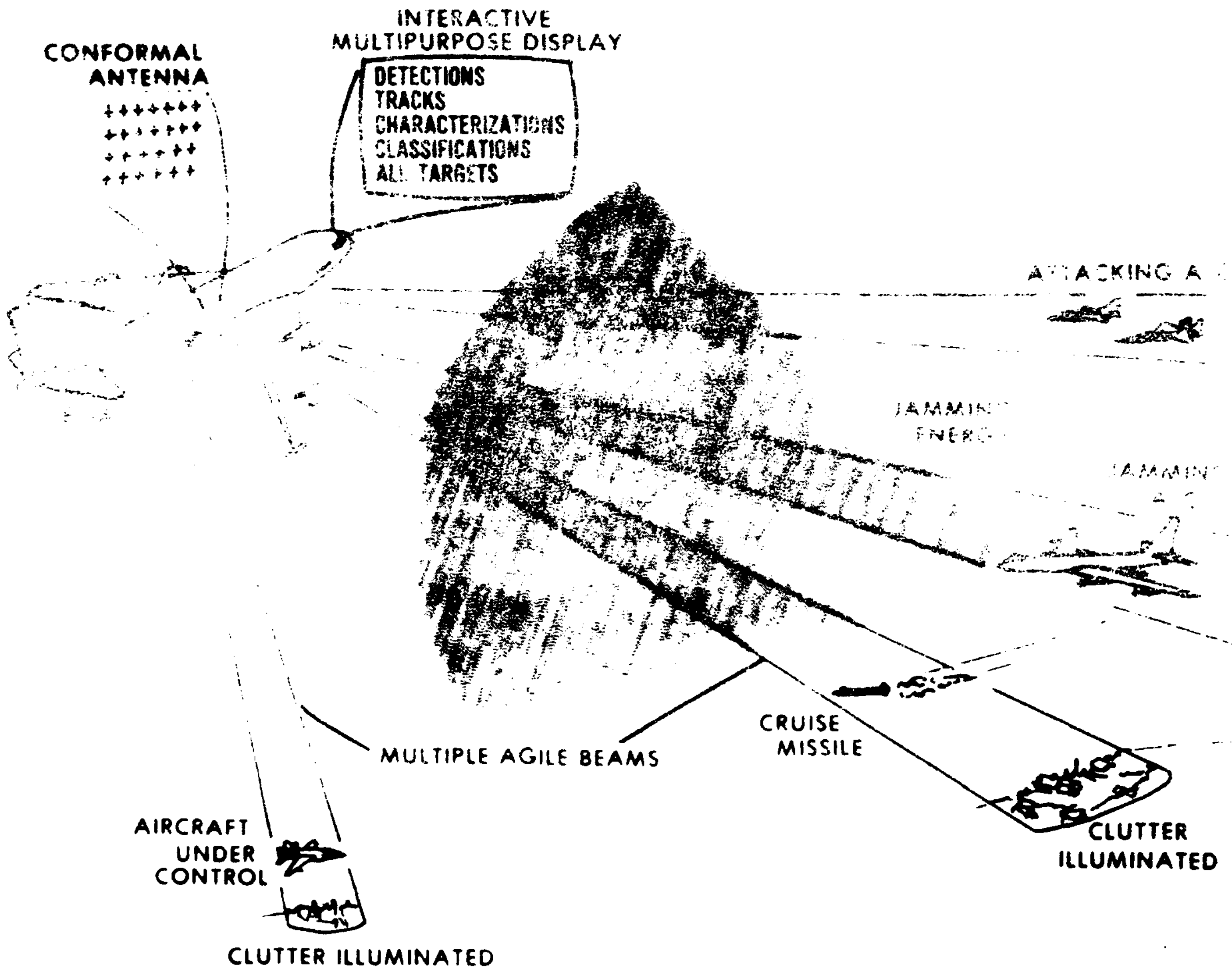
FABRICATION OF LABORATORY MOCKUP & TESTING FY 85

TRANSITION TO SPO FOR ADVANCED MODEL & AIRBORNE TESTS FY 87

START DATE/DURATION: FY 82 5 YEARS

FUNDS (TOTAL 6.3): $4.6M

ADVANCED AIRBORNE SURVEILLANCE RADAR



ADVANCED E3A RADAR TECHNOLOGY

APPROACH:

ESTABLISH POST- 1990 THREAT

EXPLOIT NEW TECHNOLOGY

- ADAPTIVE, AGILE, MULTIPLE BEAMS
- SOLID STATE TRANSMIT-RECEIVE MODULES
- VHSI TECHNIQUES FOR:
  - OVERALL SENSOR CONTROL
  - ADAPTIVE PROCESSING
  - WAVEFORM CONTROL
- MULTISTATIC & ESM - SURVIVABILITY

SENSOR CANDIDATE DECISIONS

DESIGN, FABRICATION & TEST OF CRITICAL SUBSYSTEMS

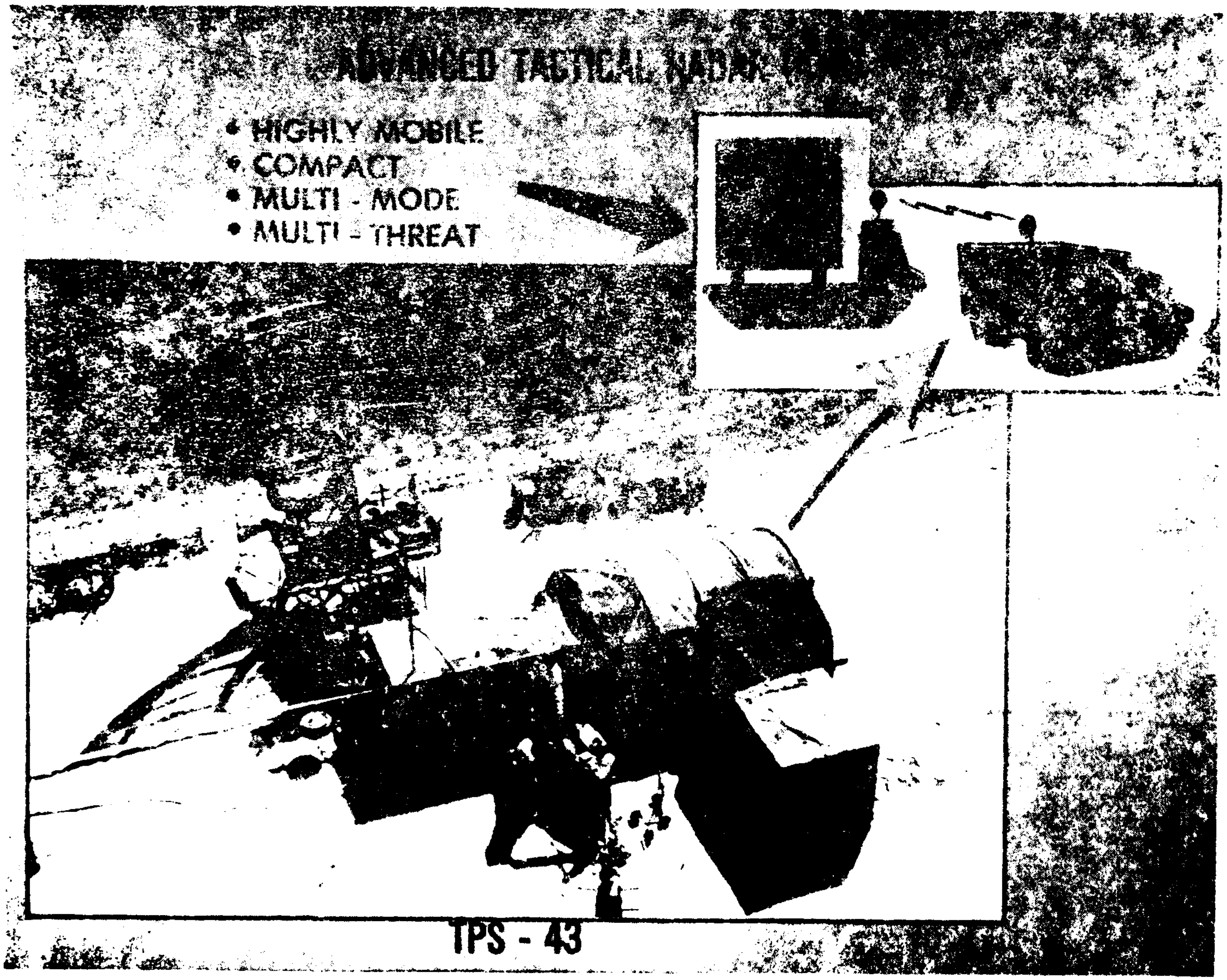
ADVANCED TACTICAL RADAR

OBJECTIVE — DEVELOP ADVANCED TACTICAL RADAR TO MEET THE MULTI THREAT ENVIRONMENT OF 1990's

APPROACH — DESIGN, FABRICATE AND FULLY TEST TWO ADVANCED TACTICAL RADAR DIVERGENT DESIGN (S-BAND, C-BAND) RADAR MODELS

START DATE/DURATION: FY82 - 86

FUNDS (TOTAL FY82 - 86) 15.2M


ADVANCED TACTICAL
• HIGHLY MOBILE
• COMPACT
• MULTI - MODE
• MULTI - THREAT
TPS - 43

AIRCRAFT IDENTIFICATION

AF PROBLEMS BEING ADDRESSED:

- TIMELY AND OPTIMUM ALLOCATION OF AIR WEAPON RESOURCES FOR AIR COMMAND AND CONTROL FUNCTIONS

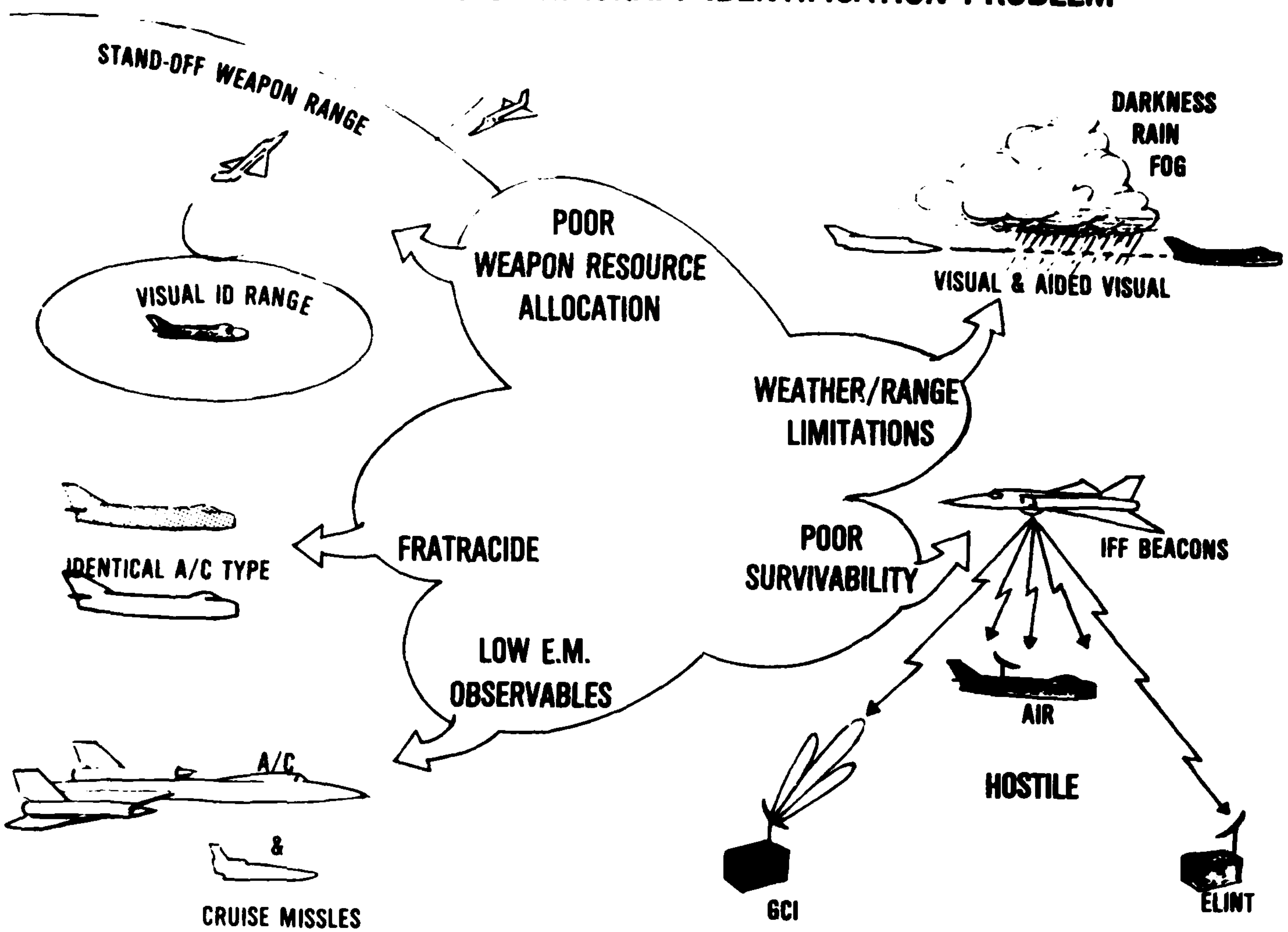
SPECIFIC OBJECTIVE:

- PROVIDE REAL TIME, ALL WEATHER, DAY/NIGHT, LONG RANGE IDENTIFICATION & CLASSIFICATION OF HOSTILE AND FRIENDLY AIRCRAFT

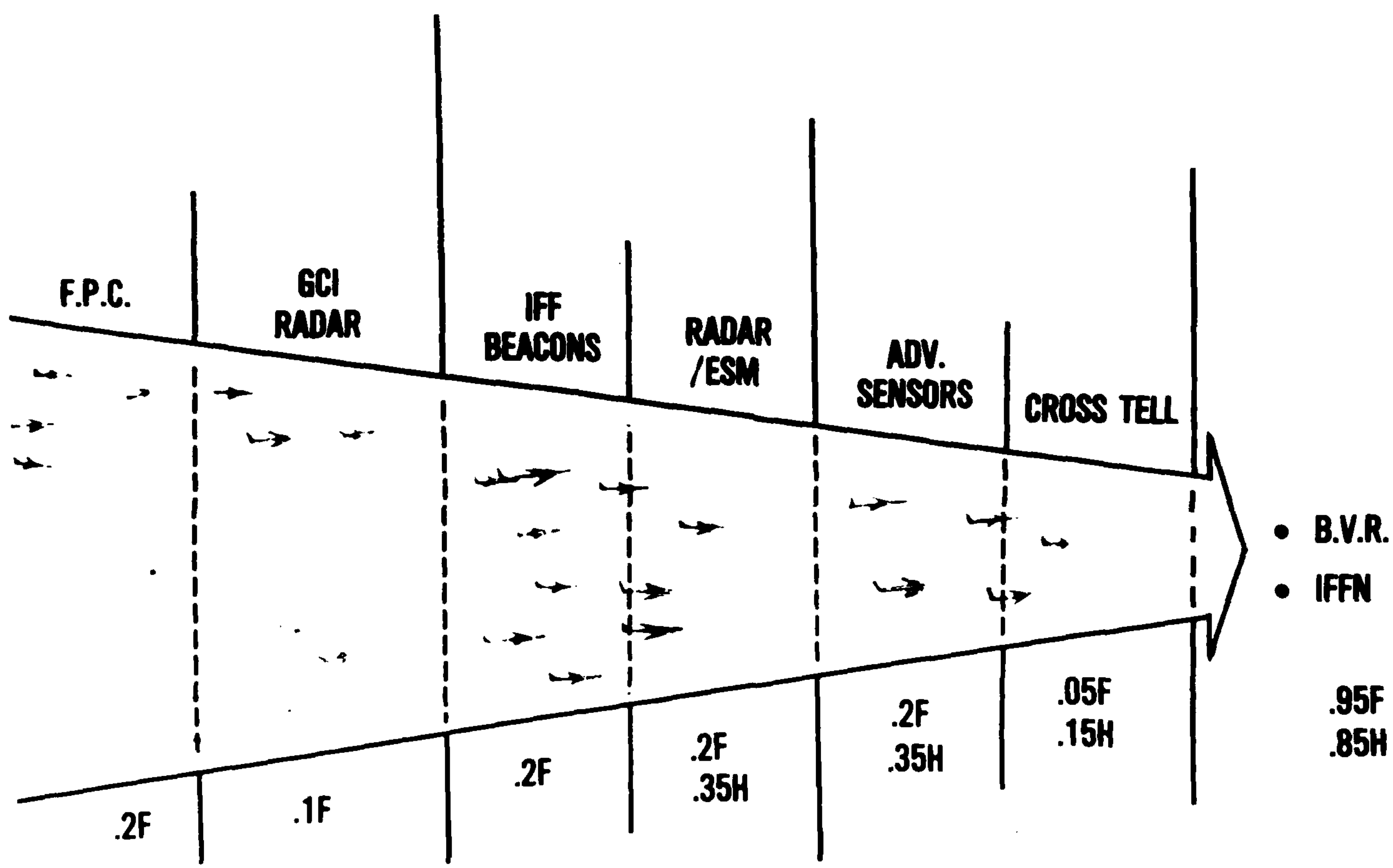
APPROACH:

- UTILIZATION OF COHERENT WIDEBAND RADAR DATA FOR SIZE & SHAPE
- OPTIMUM QUIET IDENTIFICATION CONCEPT FOR OWNERSHIP
- REAL TIME INTERACTIVE PROCESSING
- MULTI FUNCTION RADAR CONCEPTS
- MULTIPLE SENSOR SYNERGISM

ASSESSMENT OF AIRCRAFT IDENTIFICATION PROBLEM



RATIONALE FOR MULTI-SENSOR APPROACH



STRATEGIC SURVEILLANCE

HIGH PRIORITY ACTIVITIES:

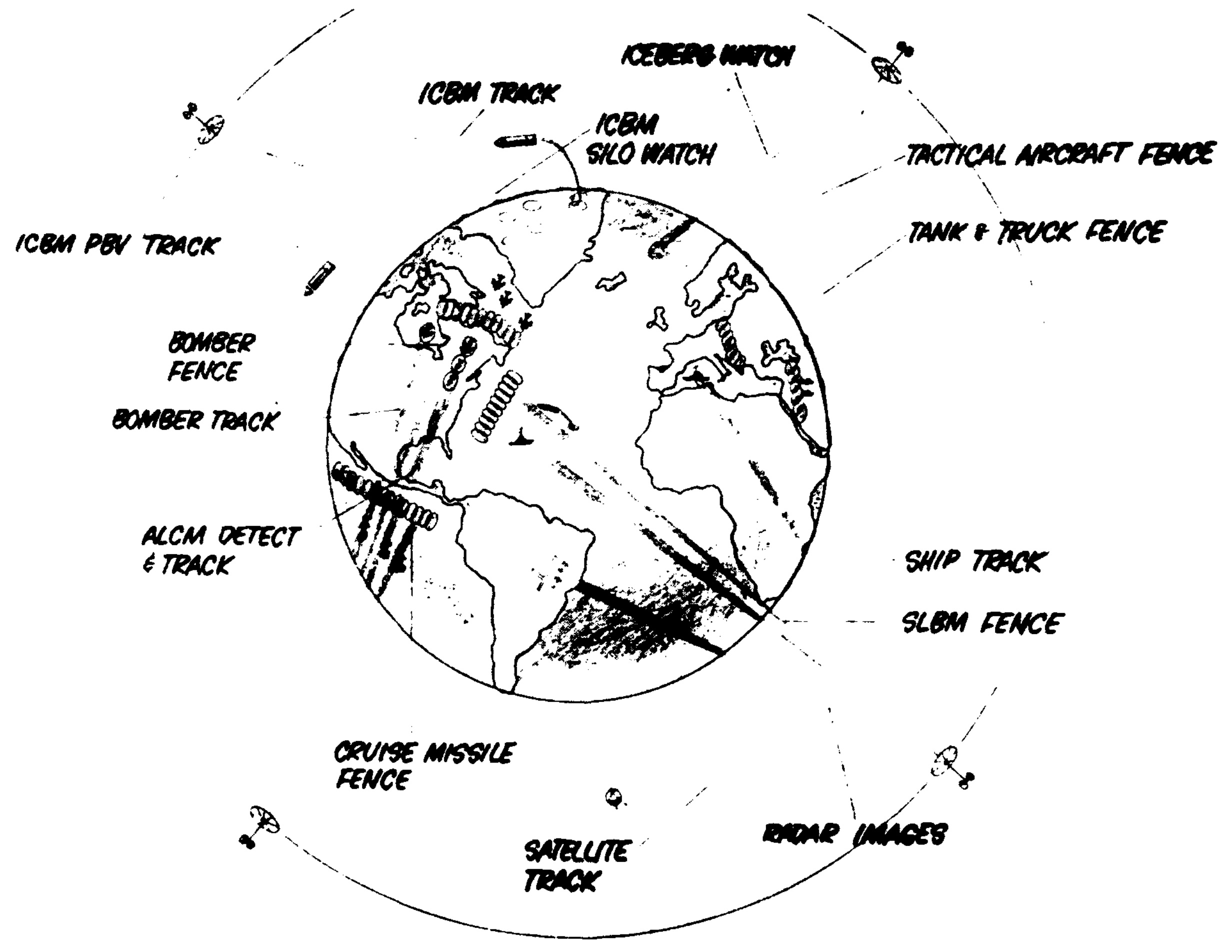
- SPACE BASED RADAR
  - GLOBAL, ALL WEATHER COVERAGE
  - MULTI– MISSION
- CRUISE MISSILE SURVEILLANCE
  - STRESSING THREAT
    - LOW - SLOW- SMALL
  - MULTI- SPECTRAL, MULTI-SENSOR

SPACE BASED RADAR

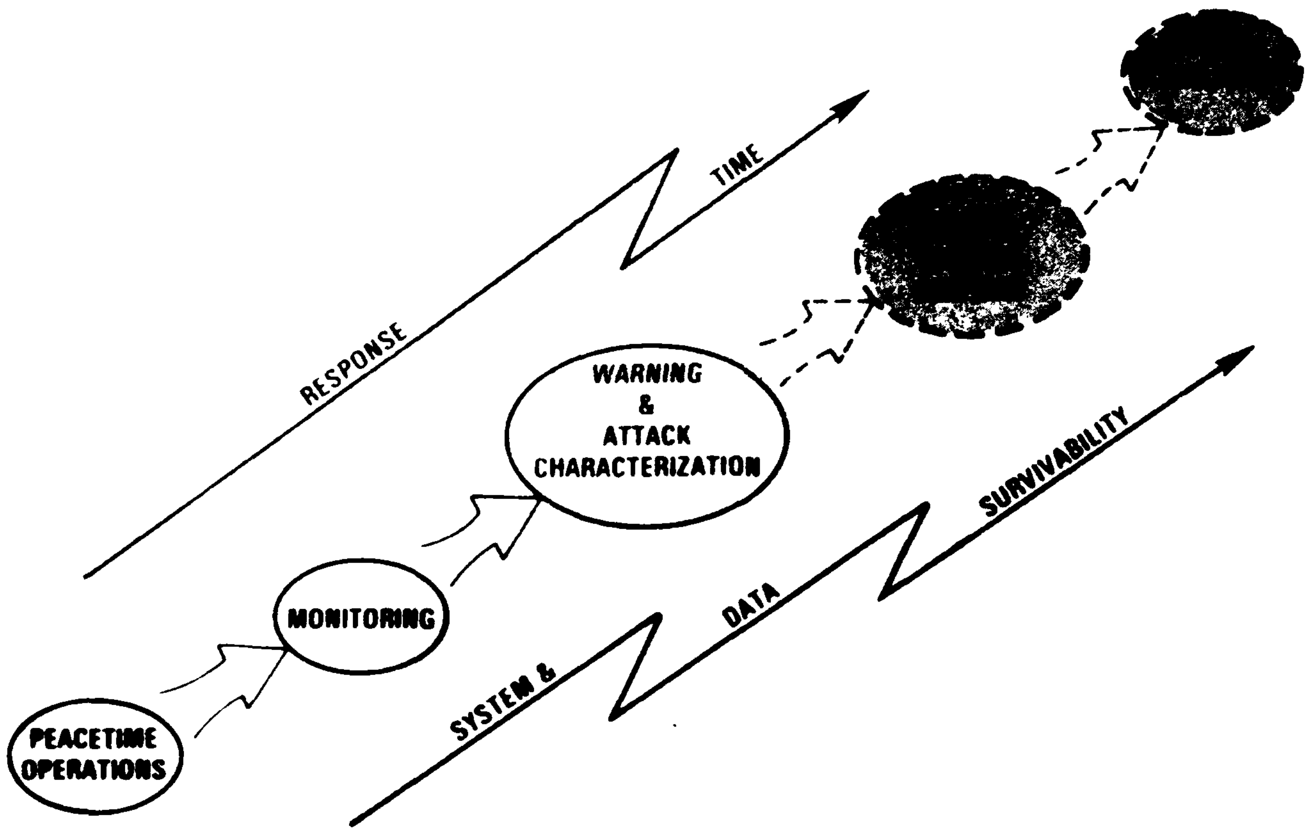
OBJECTIVE:	INVESTIGATE CRITICAL TECHNOLOGIES & SYSTEM CONCEPTS FOR GLOBAL, MULTI-MISSION SPACE BASED RADAR
APPROACH:	SYSTEM-SUBSYSTEM CONCEPTUAL/DESIGN ANALYSIS - SIMULATION MODELING LARGE APERTURE, PHASED ARRAY CONCEPTS ADVANCED ON-BOARD SIGNAL PROCESSING SOLID STATE TRANSMIT/RECEIVE MODULES
TIMELINE:	ON-GOING

TOTAL FUNDING (FY81-83) $38M

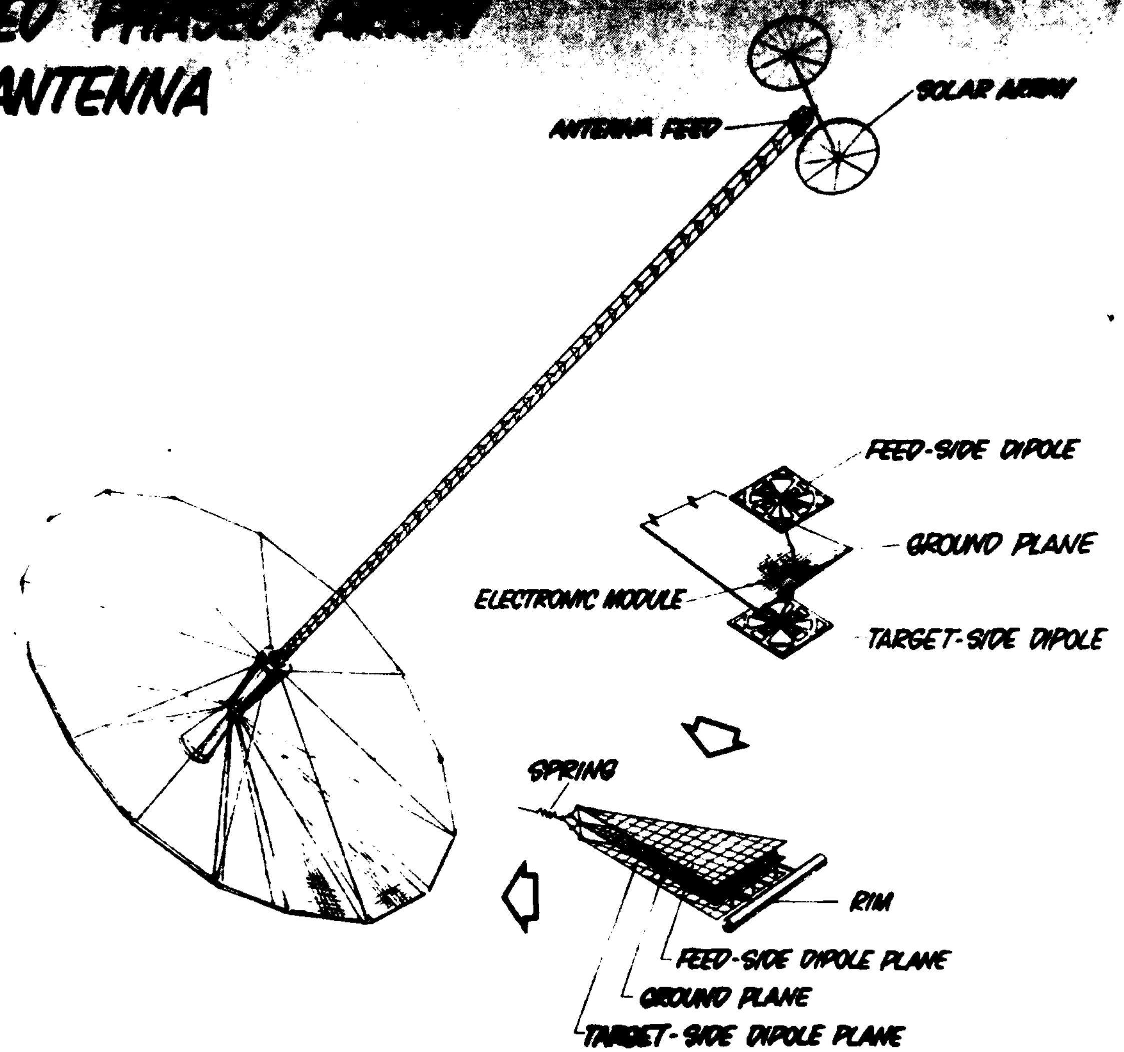
SPACED - BASED RADAR MULTI-MISSION OPERATION



SPACED-BASED RADAR MISSION AREAS



SPACED-FED PHASED ARRAY
SBR ANTENNA



RF SYSTEMS IN SPACE

OBJECTIVE: DEVELOP/IMPROVE SYSTEM/SUBSYSTEM ANALYTICAL CAPABILITIES

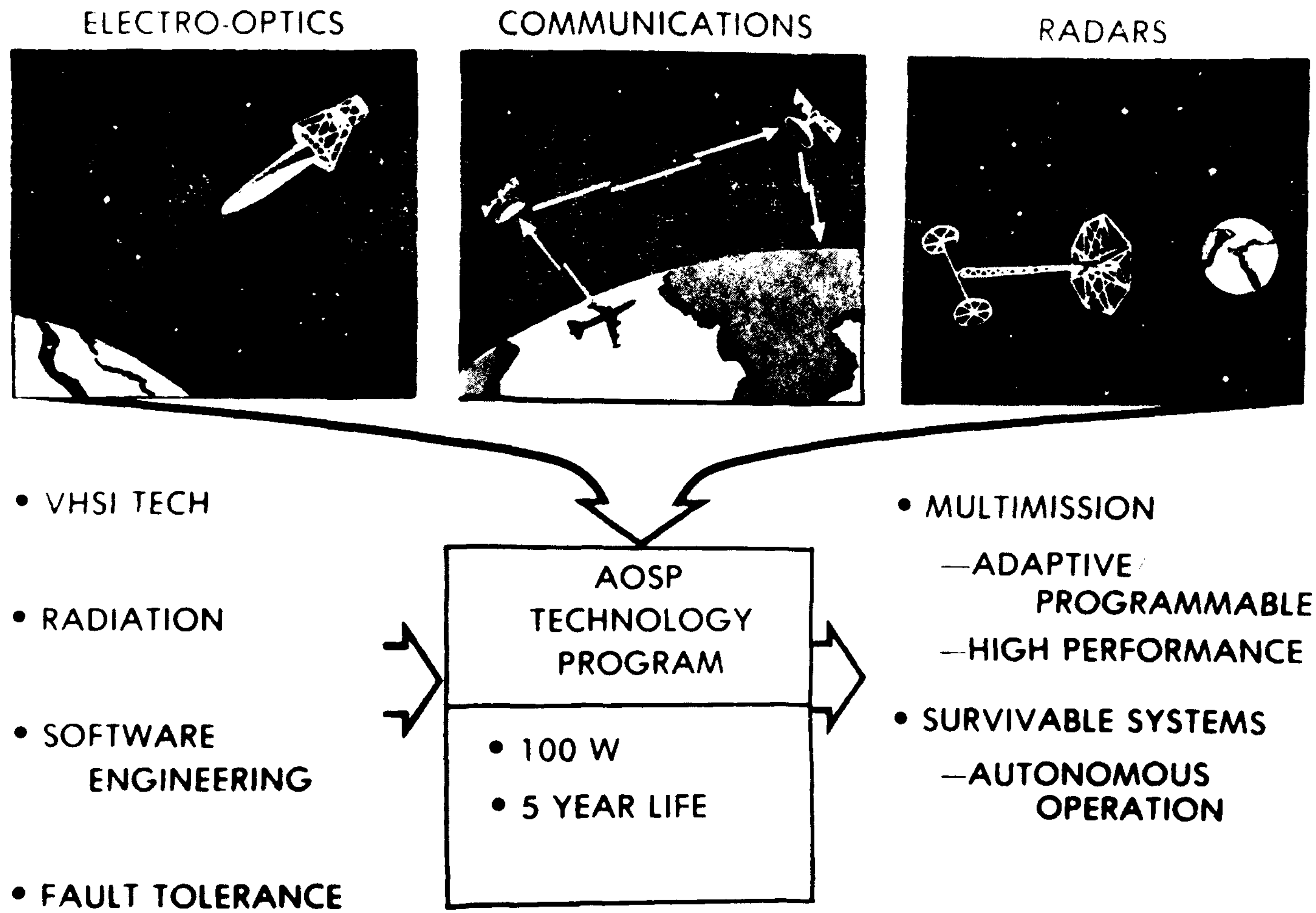
- ALTERNATIVE SPACE BASED RADAR CONCEPTS

APPROACH: MULTI-TASK

- RF SUBSYSTEM PERFORMANCE ANALYSES
  - LARGE APERTURE PHASED ARRAYS
  - CALIBRATION - COMPENSATION TECHNIQUES
- GROUND TEST PROCEDURES DESIGN
- SURVIVABILITY ANALYSIS

START/DURATION JAN 81 / 18 MONTHS

ADVANCED ONBOARD SIGNAL PROCESSOR (AOSP)



TRANSMIT/RECEIVE MODULE IMPACT

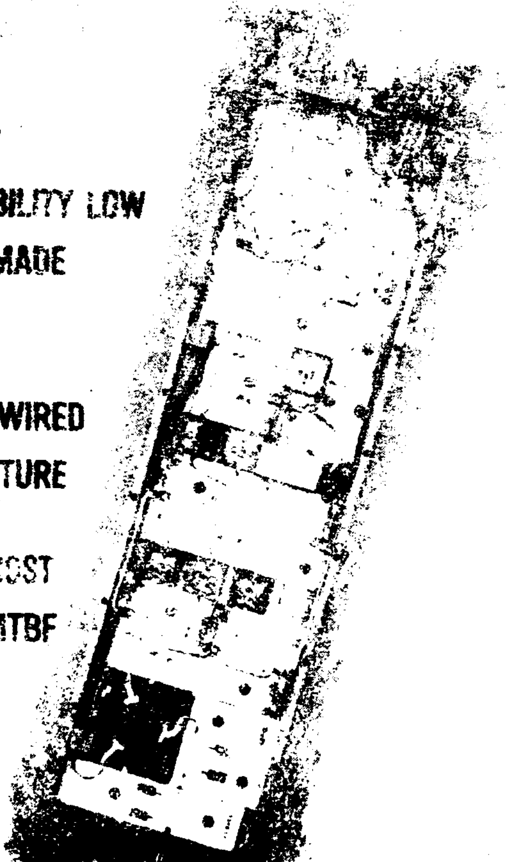
1979

MODULE

- LARGE
- HEAVY
- RELIABILITY LOW
- HANDMADE

SYSTEM

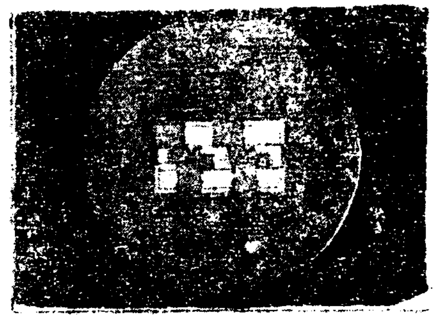
- HARD WIRED
- STRUCTURE HEAVY
- HIGH COST
- LOW MTBF



1985

MODULE

- LIGHT
- INTEGRATED LOGIC
- ADAPTIVE
- MASS PRODUCTION



SYSTEM

- FLEXIBLE
- LOW COST
- LIGHTWEIGHT
- HIGH MTBF

CRUISE MISSILE (CM) SURVEILLANCE

OBJECTIVE: COST-EFFECTIVE WARNING SYSTEM OPTIONS FOR DETECTION, TRACKING & IDENTIFICATION OF PROJECTED CM THREATS

APPROACH: MULTISTATIC RADAR CONCEPTS
ESM/RADAR INTEGRATION
SENSOR CUEING
6.3 DEMONSTRATIONS & VALIDATION FY 83 - 85

START DATE/DURATION: FY 82 5 YEARS

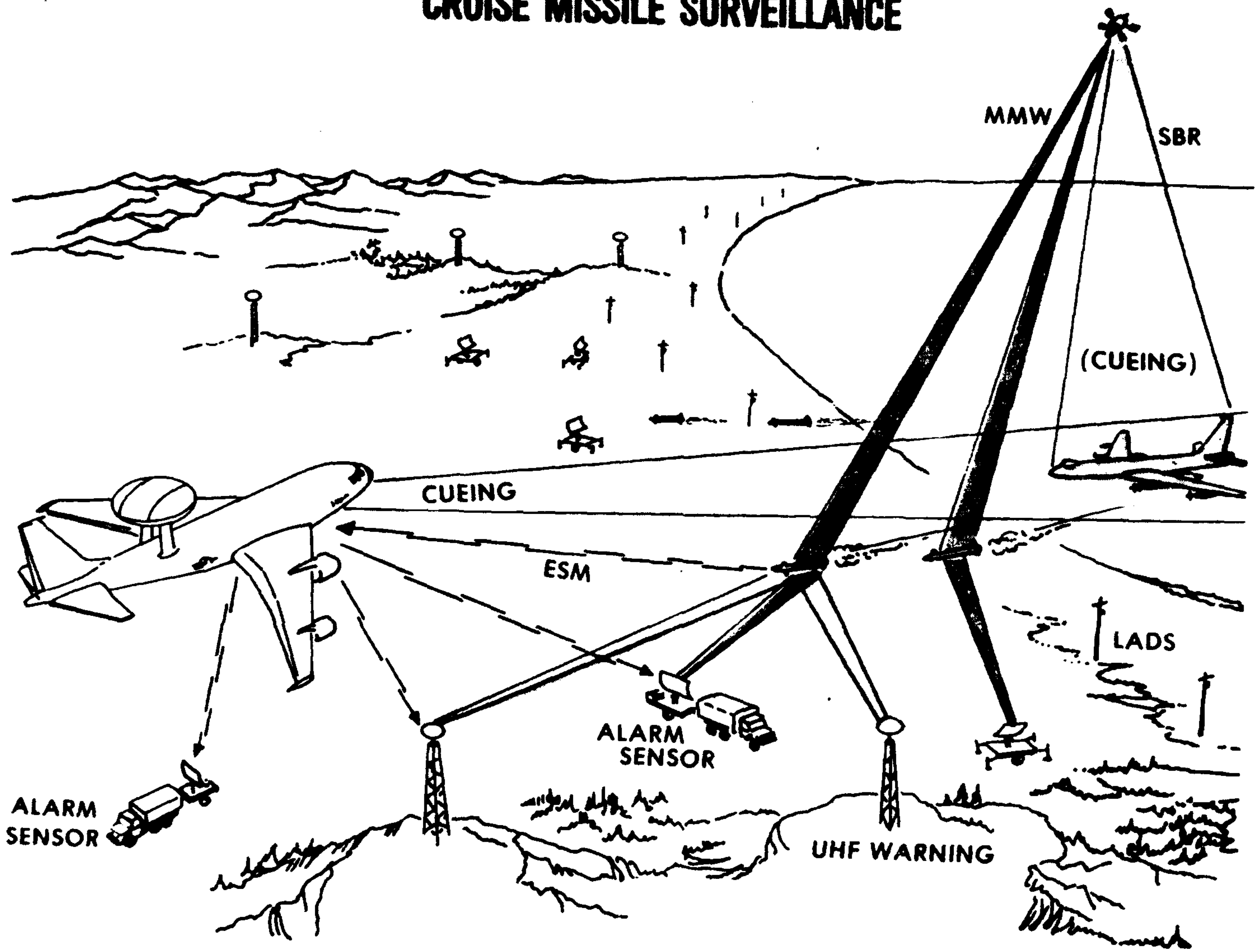
FUNDS (TOTAL): $7.4M

CRUISE MISSILE SURVEILLANCE

OBJECTIVES:

- PROVIDE WARNING OPTIONS PRIOR TO USSR DEPLOYMENT OF ADP-IV, TOMAHAWK VARIANT
- PROVIDE THEATER WARNING CONSISTENT WITH ENGAGEMENT CAPABILITY
- ADDRESS STRATEGIC WARNING REQUIRED BY ADVANCED AIR DEFENSE CONCEPTS

CRUISE MISSILE SURVEILLANCE



CRUISE MISSILE SURVEILLANCE

APPROACH:

TOTAL EXPLOITATION OF ALL POSSIBLE E. M. OBSERVABLES TO NULLIFY PENETRATION

- VHF/UHF MULTISTATICS
- ALARM SENSOR
- ESM AUGMENTATION
- MMW

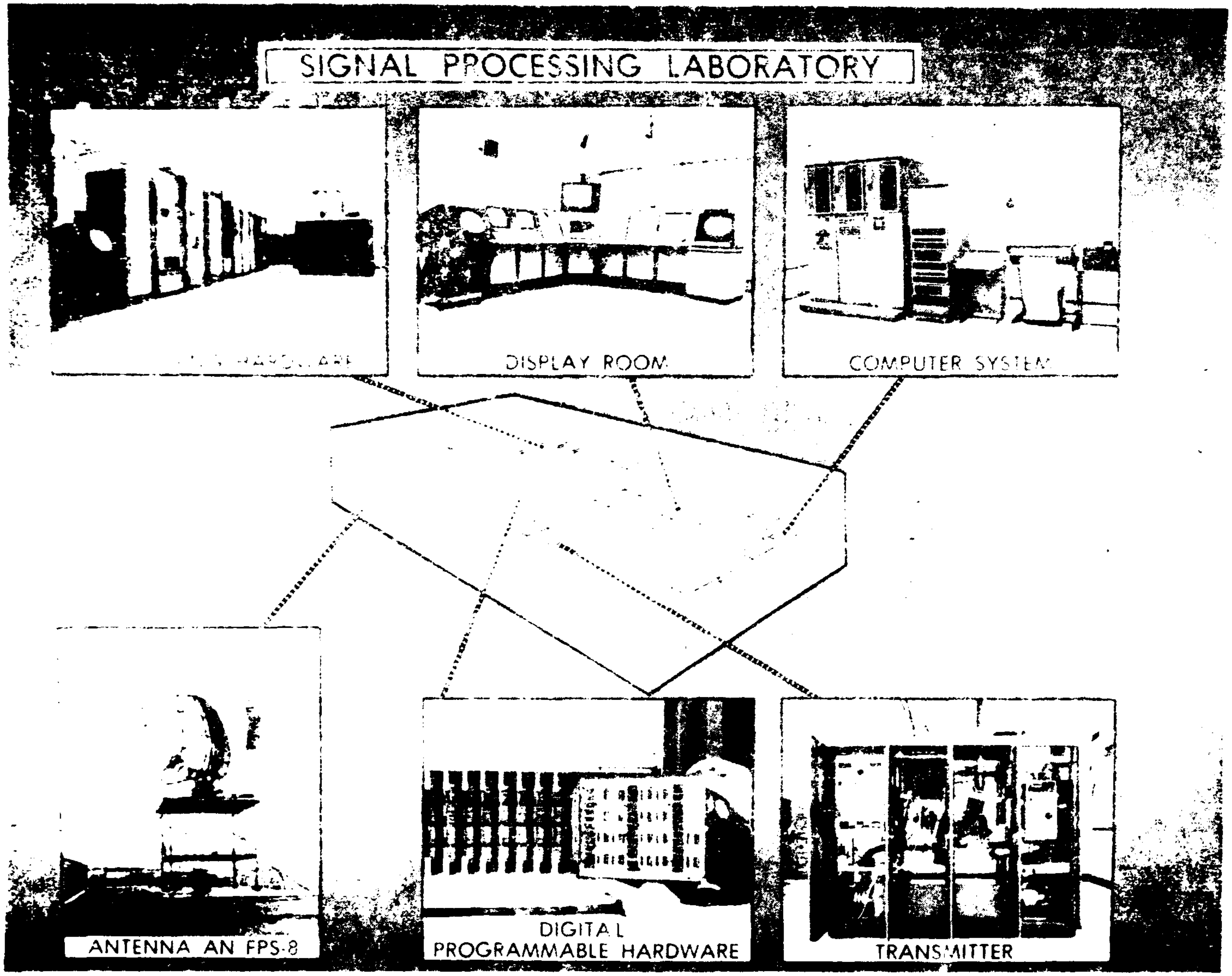
MULTIPLE SENSOR CONCEPTS EMPLOYING CUEING BASED ON ASM CARRIER TRACK INFORMATION

MISSION ANALYSIS

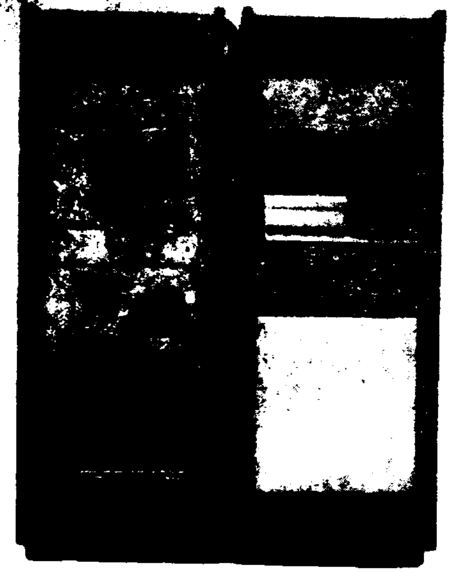
DEMONSTRATION & VALIDATION

SURVEILLANCE TECHNOLOGY

- PROCESSES
  - SIGNAL PROCESSING TECHNIQUES
    - ARCHITECTURE/ALGORITHM DEVELOPMENT
    - PROCESSOR IMPROVEMENT
- THERMIONICS
  - RADAR/COMMUNICATIONS TUBES
    - ADAPTIVE TRANSMITTERS
      - TUBE
      - SOLID STATE


SIGNAL PROCESSING LABORATORY
DISPLAY ROOM
COMPUTER SYSTEM
ANTENNA AN FPS-8
DIGITAL
PROGRAMMABLE HARDWARE
TRANSMITTER

SIGNAL PROCESSOR DESIGN CONSTRAINTS

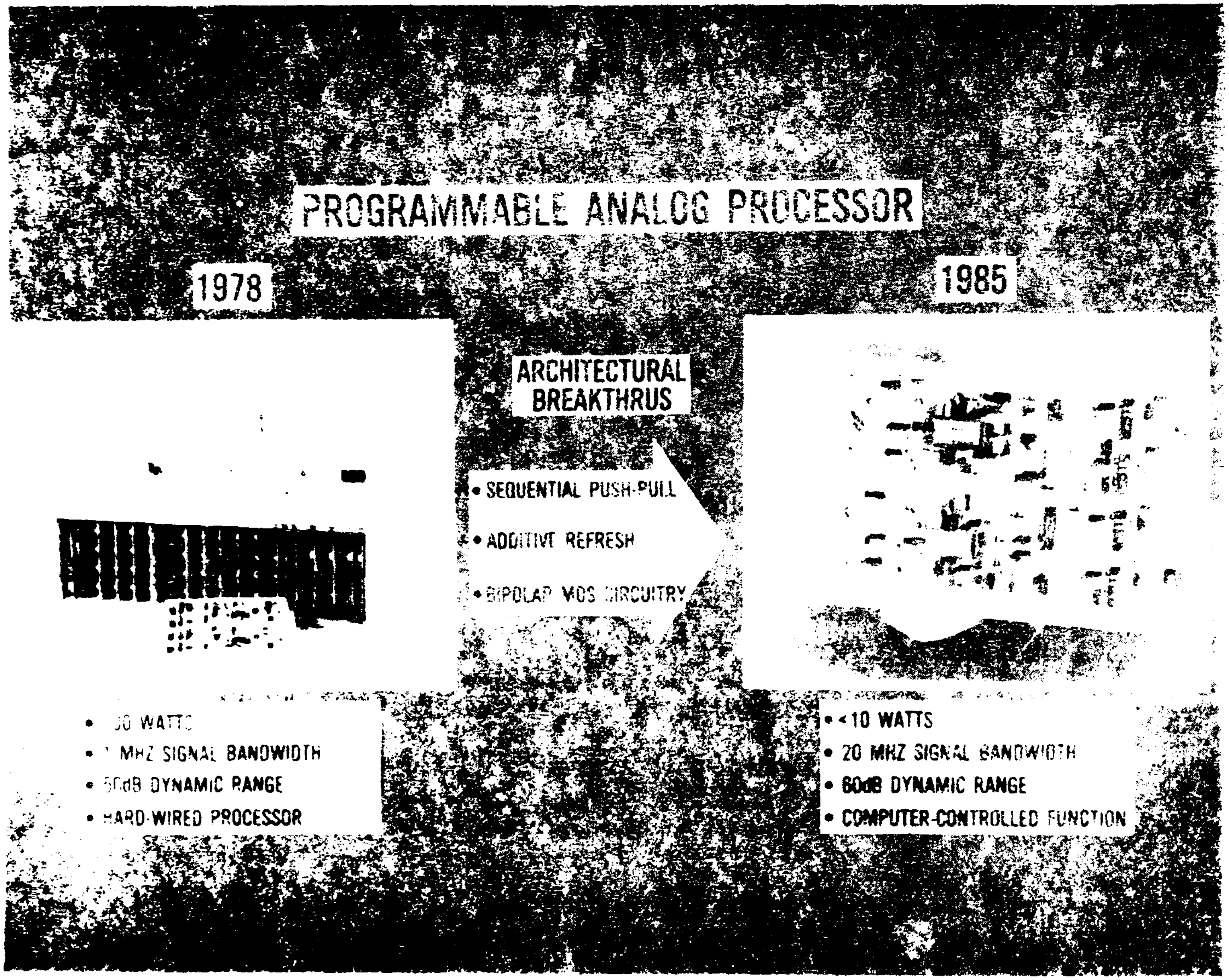


1979

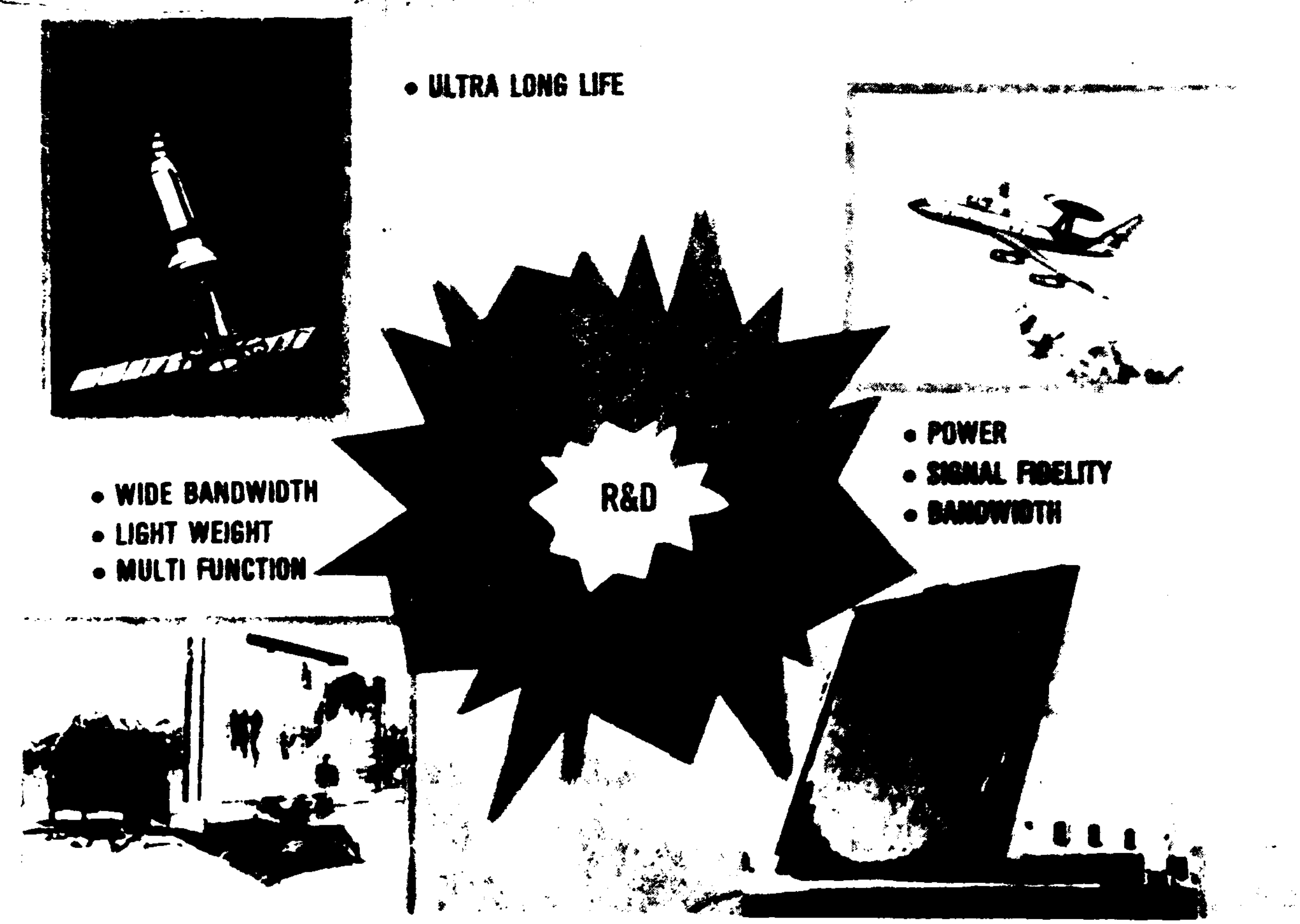
1985

- ~~SIZE~~
- ~~WEIGHT~~
- ~~POWER CONSUMPTION~~
- ~~MTBF~~
- ~~COOLING~~
- ~~COST~~

- SOFTWARE
- TECHNICAL OBSOLESCENCE
- FLEXIBILITY
- GROWTH POTENTIAL


PROGRAMMABLE ANALOG PROCESSOR
1978
1985
ARCHITECTURAL BREAKTHRUS
• SEQUENTIAL PUSH-PULL
• ADDITIVE REFRESH
• BIPOLAR MOS CIRCUITRY
WATTS
MHZ SIGNAL BANDWIDTH
DYNAMIC RANGE
HARD-WIRED PROCESSOR
• <10 WATTS
• 20 MHZ SIGNAL BANDWIDTH
• 60dB DYNAMIC RANGE
• COMPUTER-CONTROLLED FUNCTION

THERMIONICS TECHNOLOGY PROBLEM



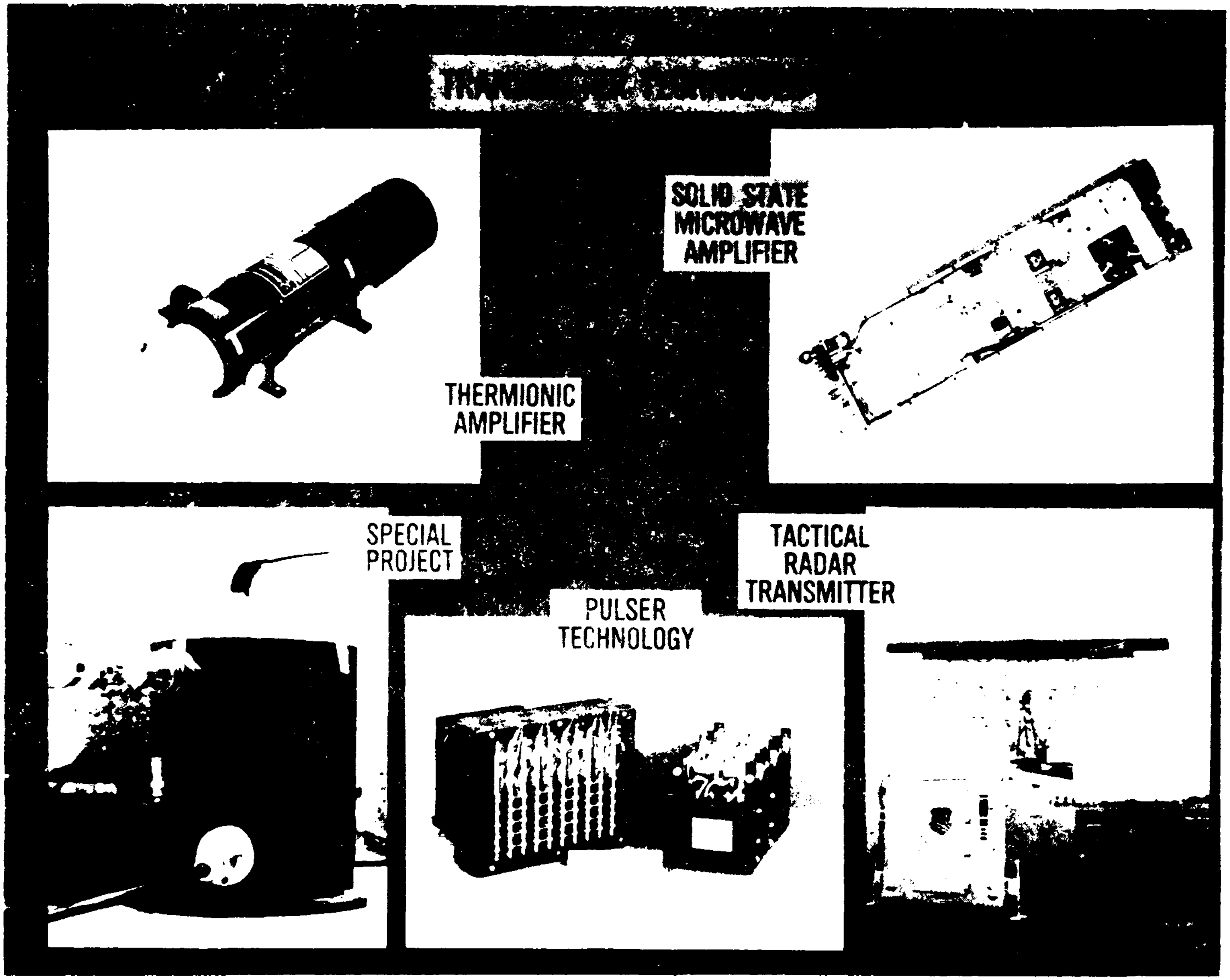
LIGHTWEIGHT/HIGH EFFICIENCY

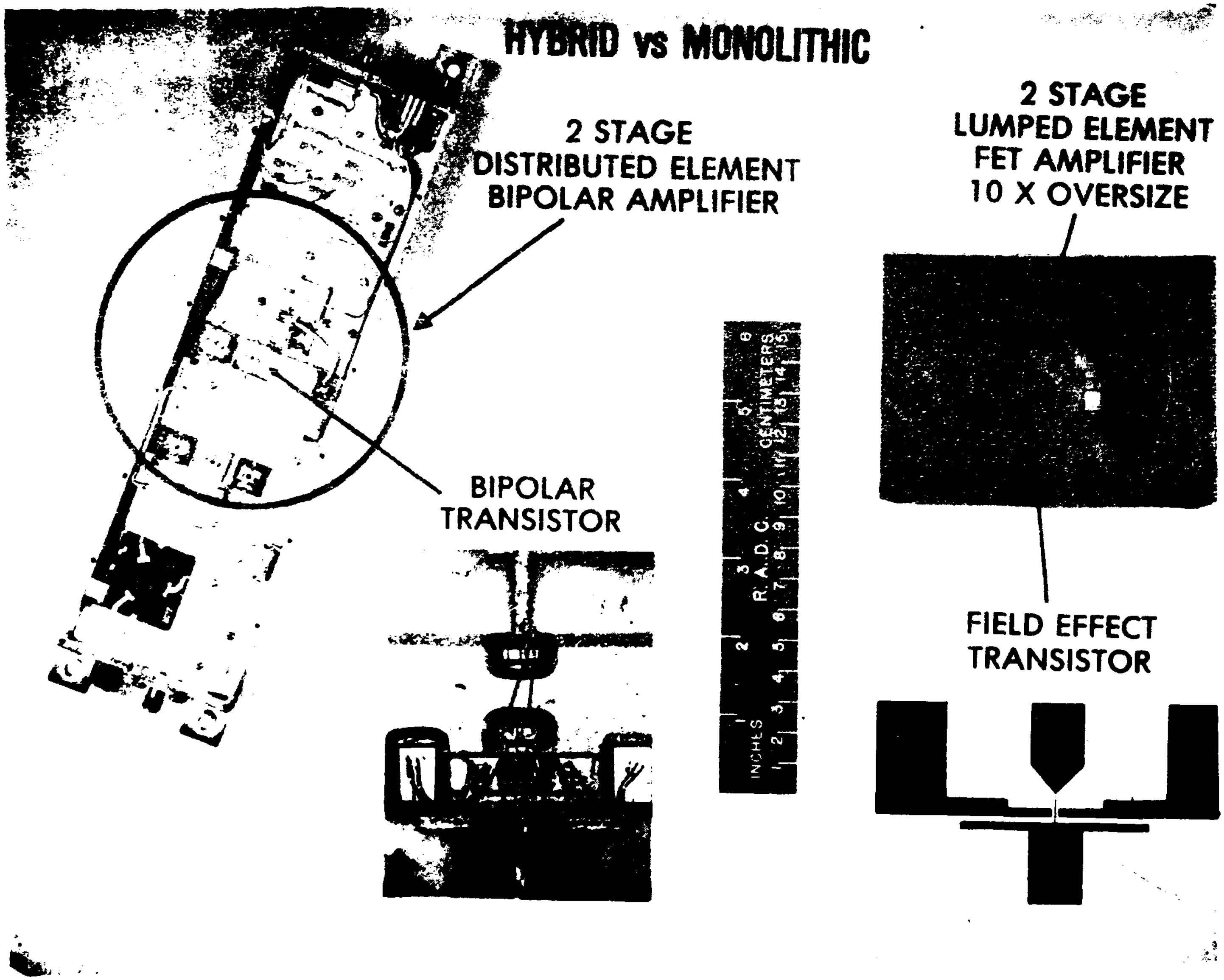
GOAL:

- DEVELOP HIGH POWER TUBE AMPLIFIERS/TRANSMITTERS THAT ARE 20% LIGHTER AND 15% MORE EFFICIENT
- DEVELOP SOLID STATE PHASED ARRAY MODULES WITH A 10:1 REDUCTION IN COST AND WEIGHT

PAYOFF:

- INCREASED SYSTEM SURVIVABILITY/PERFORMANCE VIA:
  - INCREASED MOBILITY
  - LESS FUEL CONSUMPTION
  - REDUCED PRIME POWER REQUIREMENT
  - MULTIFUNCTION OPERATION


THERMIONIC AMPLIFIER
SOLID STATE MICROWAVE AMPLIFIER
SPECIAL PROJECT
PULSER TECHNOLOGY
TACTICAL RADAR TRANSMITTER


HYBRID vs MONOLITHIC
2 STAGE
DISTRIBUTED ELEMENT
BIPOLAR AMPLIFIER
BIPOLAR
TRANSISTOR
INCHES
R.A.D.C.
CENTIMETERS
2 STAGE
LUMPED ELEMENT
FET AMPLIFIER
10 X OVERSIZE
FIELD EFFECT
TRANSISTOR

SURVEILLANCE DIVISION
MINI-SESSION PRESENTATIONS
TUESDAY, 3 JUNE 1980

RADC - BLDG 106 - AUDITORIUM

1:45 PM SURVEILLANCE ECCM - MR. SHIELDS
AIR CRAFT IDENTIFICATION - MR. WOLF

3:15 PM SPACE BASED RADAR - MR. SIMONS
CRUISE MISSILE SURVEILLANCE - MR. OGRODNIK

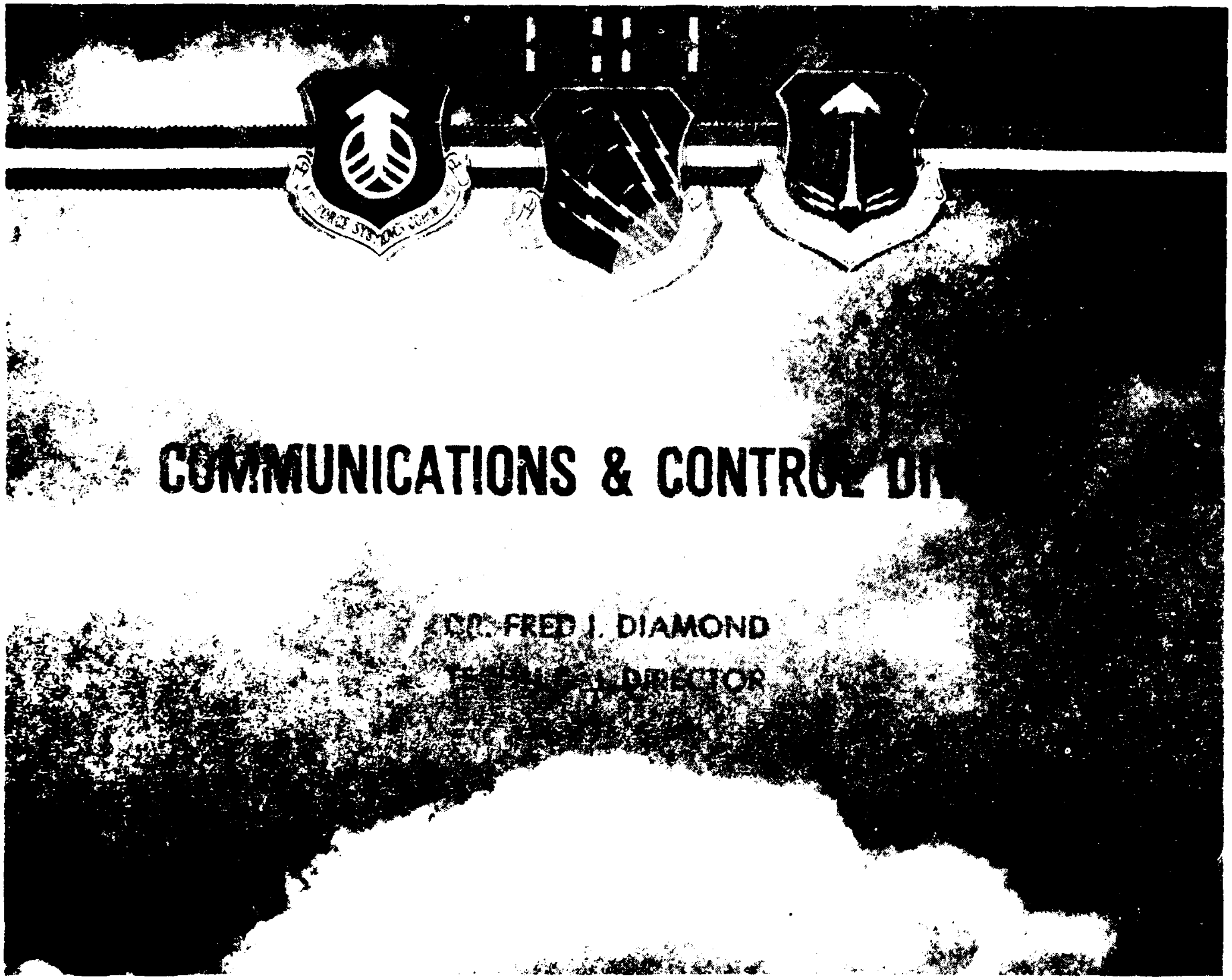
SURVEILLANCE DIVISION
POINTS OF CONTACT

SURVEILLANCE/ECCM (TACTICAL) - MR. T. SHIELDS
(315) 330-4496

AIRCRAFT IDENTIFICATION - MR. W. WOLF
(315) 330-4431

SPACE BASED RADAR - MR. J. SIMONS
(315) 330-3573

CRUISE MISSILE SURVEILLANCE - MR. R. OGRODNIK
(315) 330-4431


COMMUNICATIONS & CONTROL
FRED J. DIAMOND
DIRECTOR

COMMUNICATIONS OVERVIEW

- INTRODUCTION
- LONG TERM OBJECTIVES
- NEW INITIATIVES
- MAJOR PROGRAM AREAS
- SUMMARY

LONG TERM OBJECTIVES

- ECCM
- ADAPTIVE COMMUNICATIONS
- C^3 COUNTERMEASURES
- MODELING & SIMULATION

NEW INITIATIVES

- SATELLITE COMMUNICATIONS
- HF COMMUNICATIONS
- FIBER OPTICS
- LOW COST DATA LINKS
- MILLIMETER AIR/AIR COMMUNICATIONS
- C^3 COUNTERMEASURES

MAJOR PROGRAM AREAS

SUPPORT C^3

- SWITCHING & ROUTING
- TERMINAL SIGNAL PROCESSING
- SYSTEM CONTROL
- SATELLITE COMMUNICATIONS
- LOS TROPO
- DCS TIMING & SYNCHRONIZATION

STRATEGIC C^3

- SUB-UHF COMMUNICATIONS

TACTICAL C^3

- OPTICAL COMMUNICATIONS
- UHF VOICE COMMUNICATIONS
- DISTRIBUTED C

C^3 COUNTERMEASURES

RECCE INTEL SURVEILLANCE

- ACTIVE TARGET LOCATION

COMMUNICATIONS TECHNOLOGY

- ADAPTIVE PROCESSING FOR COMMUNICATIO
- ADVANCED SURVIVABLE TECHNOLOGY
- C SYSTEM DESIGN & ANALYSIS

SWITCHING & ROUTING

PROGRAM GOALS

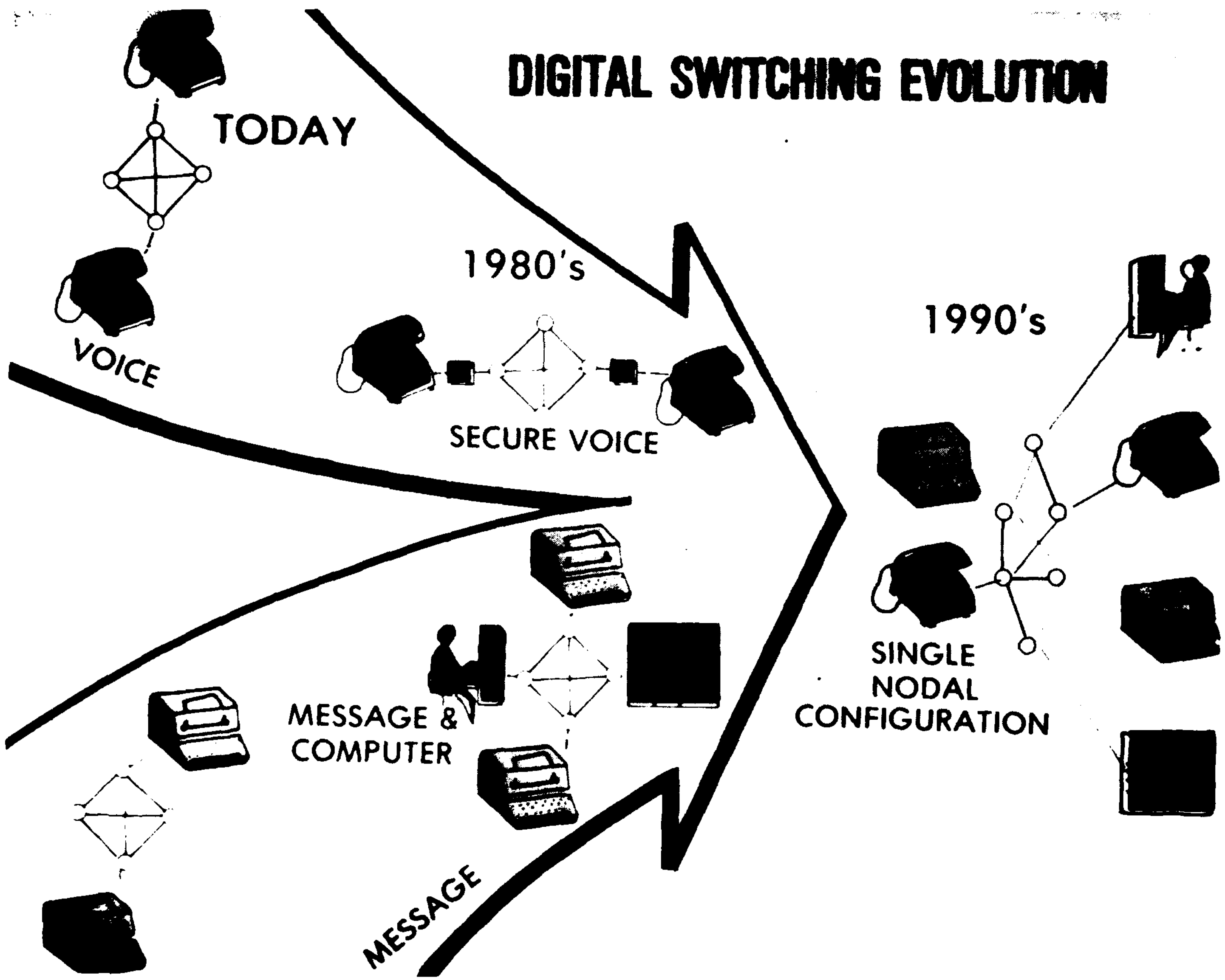
DEVELOP AN INTEGRATED SWITCHED SYSTEM
FOR DEFENSE COMMUNICATIONS SYSTEM (DCS III)

TECHNICAL AREAS

- NODAL ARCHITECTURES
- PACKET SWITCHED NETWORKS
- HIGHER ORDER LANGUAGES

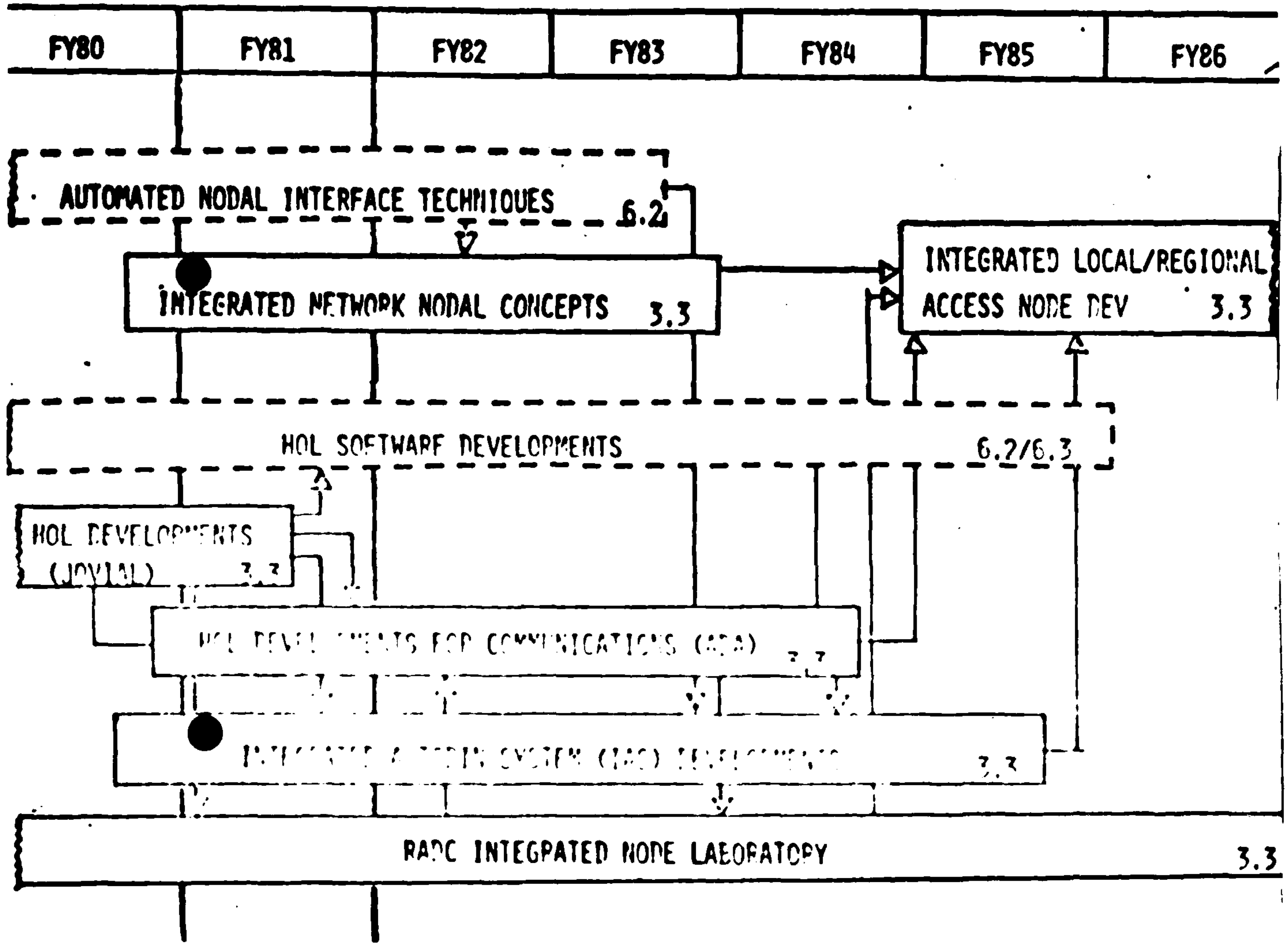
ESTIMATED FUNDING: FY 80-83 (IN THOUSANDS)

$12,517


DIGITAL SWITCHING EVOLUTION
TODAY
VOICE
1980's
SECURE VOICE
MESSAGE & COMPUTER
MESSAGE
1990's
SINGLE NODAL CONFIGURATION

RADC TPO/THRUST: 1A/SUPPORT C

SUB-SUB-THRUST: 1A. SWITCHING AND ROUTING



SYSTEM CONTROL

PROGRAM GOALS

EXPAND EXISTING SYSCON SUBSYSTEMS TO PROVIDE

- ENHANCED PERFORMANCE ASSESSMENT
- COORDINATED RESTORAL & NETWORK RESOURCE ALLOCATION
- INTEROPERABILITY SURVIVABILITY OF SYSCON ELEMENTS

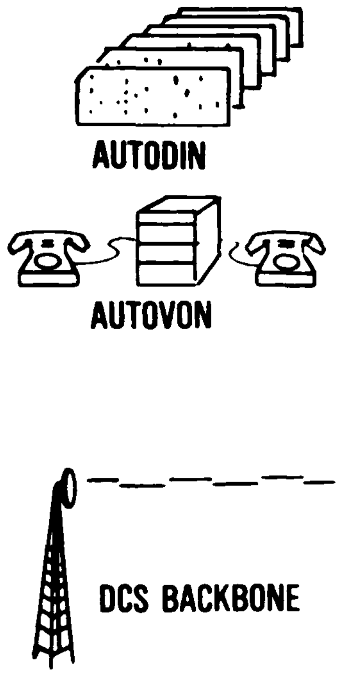
TECHNICAL AREAS

- NETWORK PARAMETER MEASUREMENT
- ECM SIGNAL DETECTION, ISOLATION, CHARACTERIZATION
- CHANNEL RECONFIGURATION
- INFORMATION PROCESSING & DISPLAYS

ESTIMATED FUNDING: FY80-83 (IN THOUSANDS)

$10,274

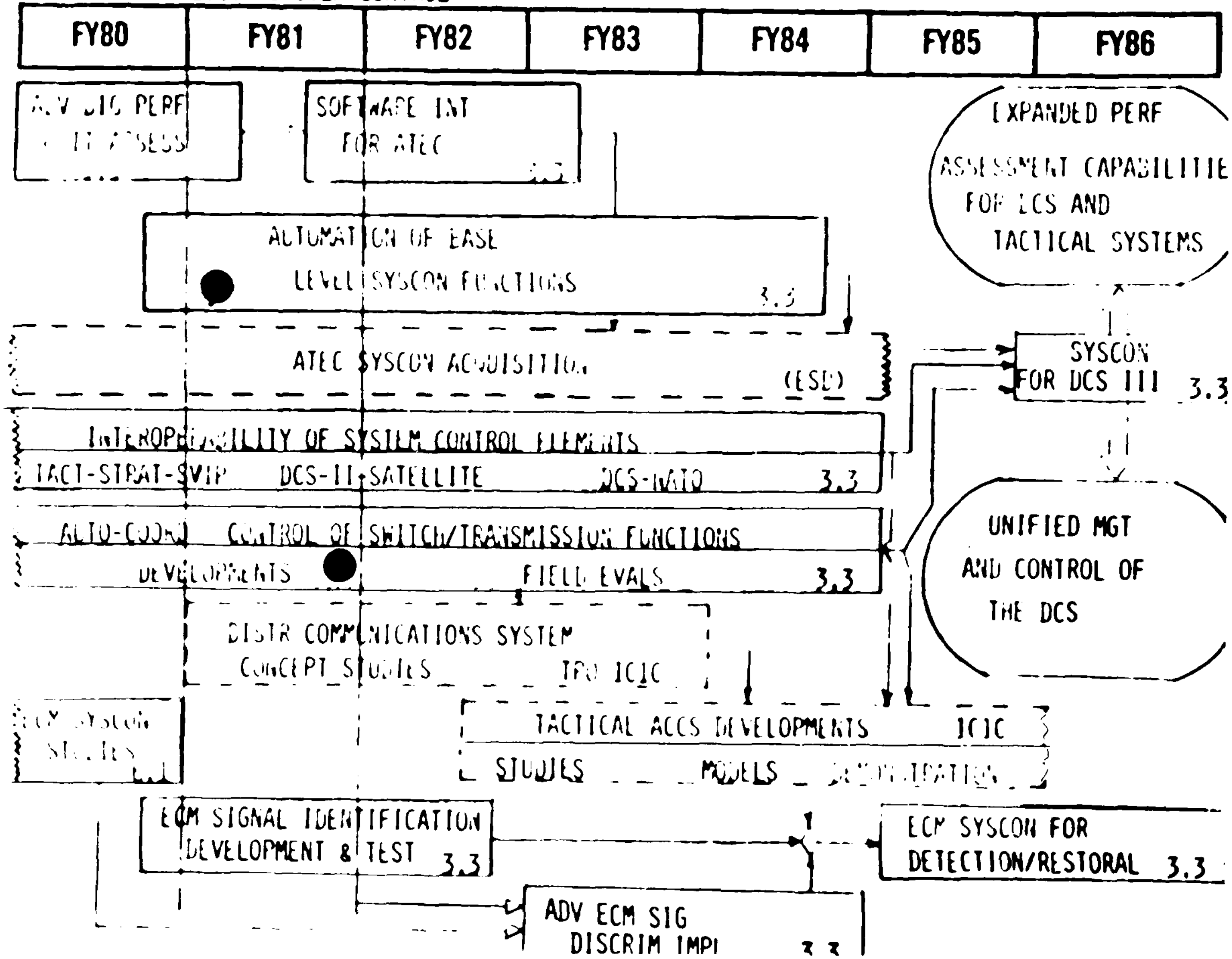
SYSTEM CONTROL



- PERFORMANCE ASSESSMENT
- NETWORK MANAGEMENT
- INTEROPERABILITY

RADC TPO I. C³/A. SUPPORT C³

THRUST: 1.C. SYSTEM CONTROL



SATELLITE COMMUNICATIONS

PROGRAM GOALS

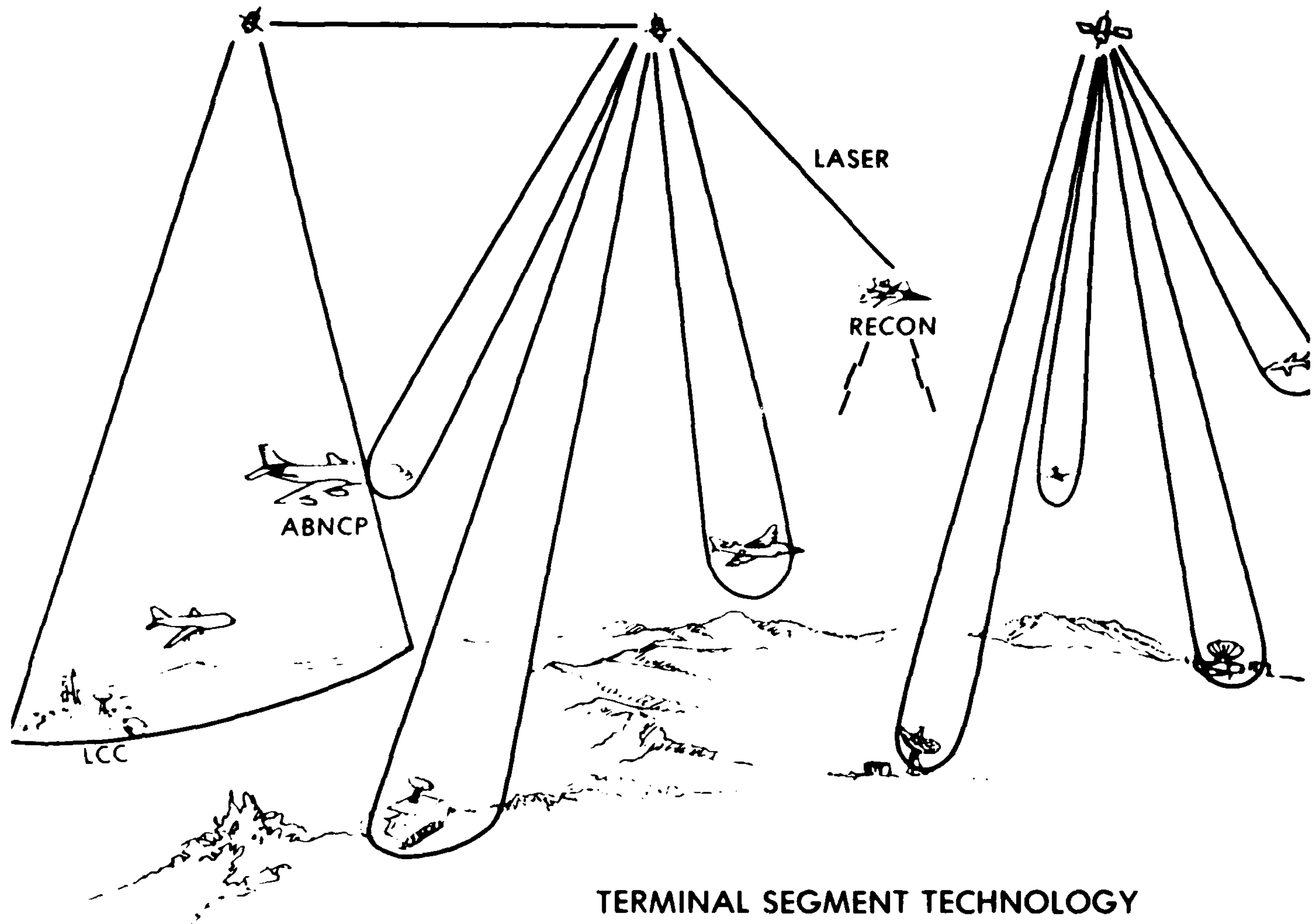
- IDENTIFY SATCOM REQUIREMENTS
- DEVELOP & DEMONSTRATE ADVANCED TERMINALS

TECHNICAL AREAS

- A/B TERMINALS
- SPACE SUBSYSTEMS
- ECCM/SURVIVABILITY

ESTIMATED FUNDING FY80-83 (IN THOUSANDS)
$54,934

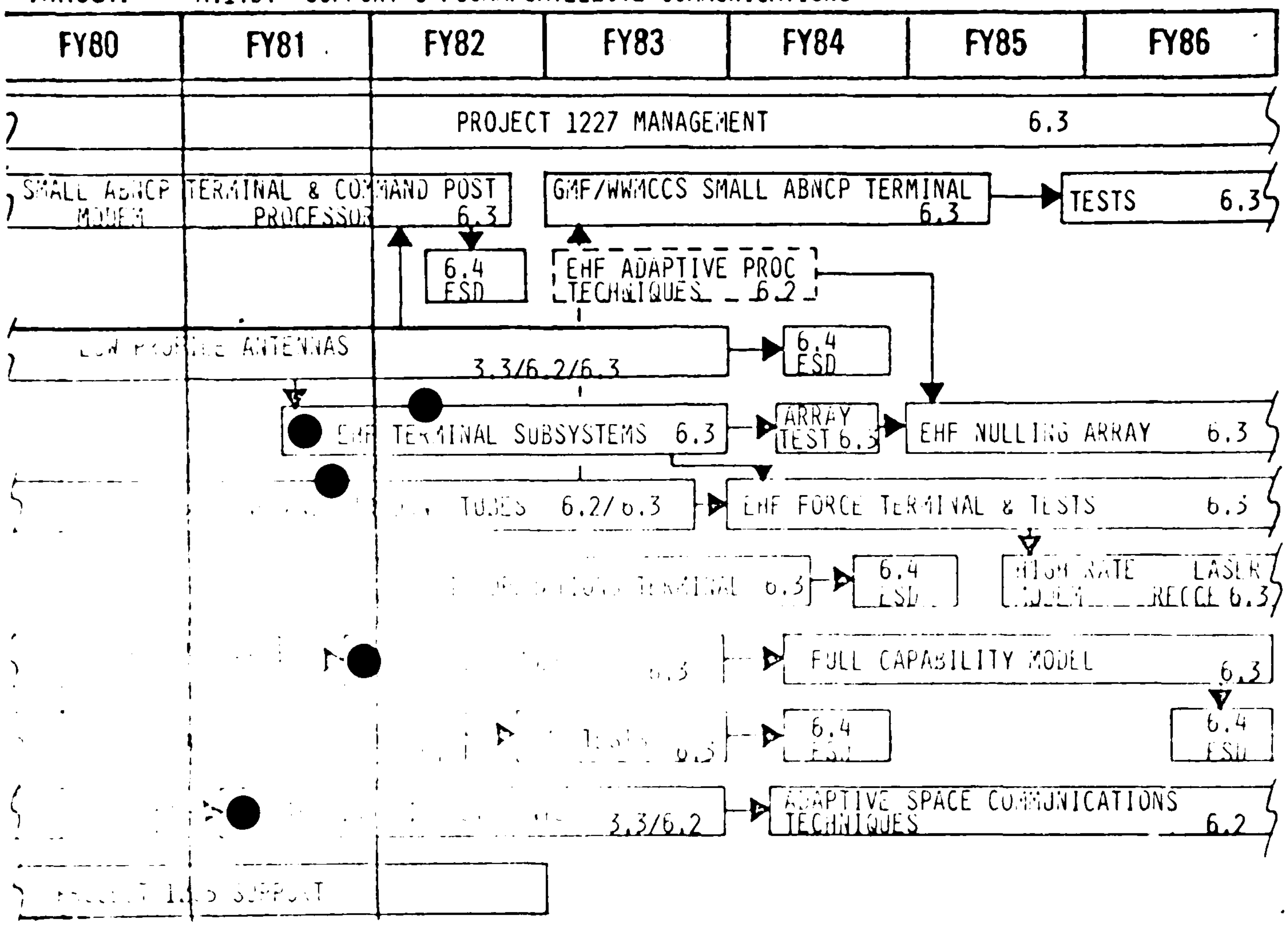
SATCOM



TERMINAL SEGMENT TECHNOLOGY

RADC TPO 1 C^3

THRUST: A.1.D. SUPPORT C^3/COMM/SATELLITE COMMUNICATIONS



LOS/TROPO

PROGRAM GOALS

TRANSMISSION OVER MILITARY LOS/TROPO CHANNELS WITH

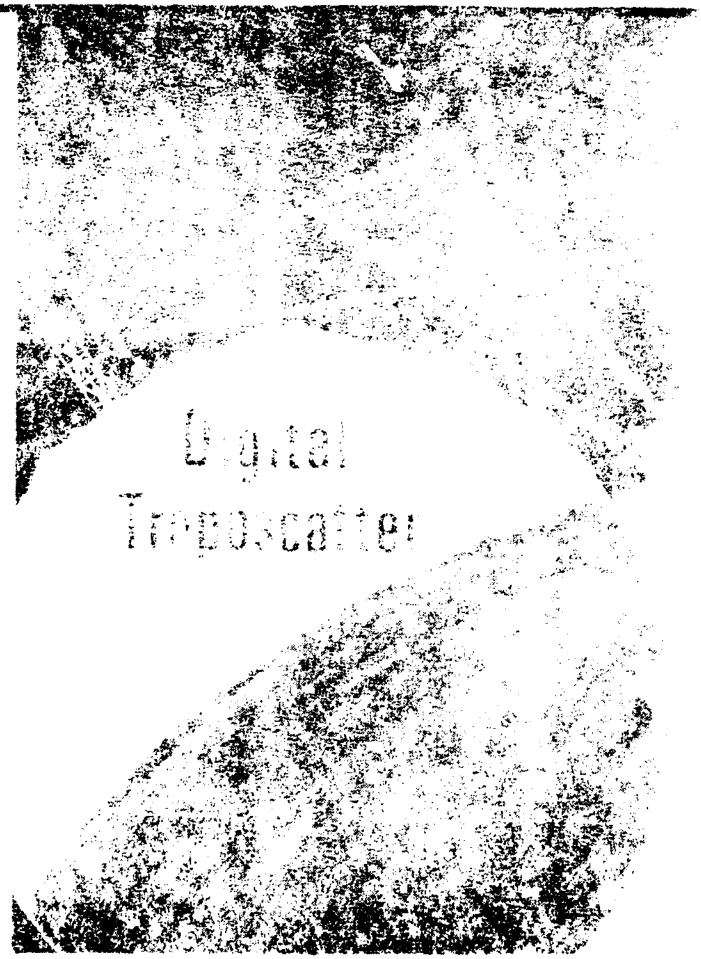
- HIGH AVAILABILITY (STRESSED & UNSTRESSED)
- SPECTRUM EFFICIENCY
- REDUCED VULNERABILITY

TECHNICAL AREAS

- SIGNAL PROCESSING
- RADIO DESIGN
- ANTENNA SIGNAL PROCESSING

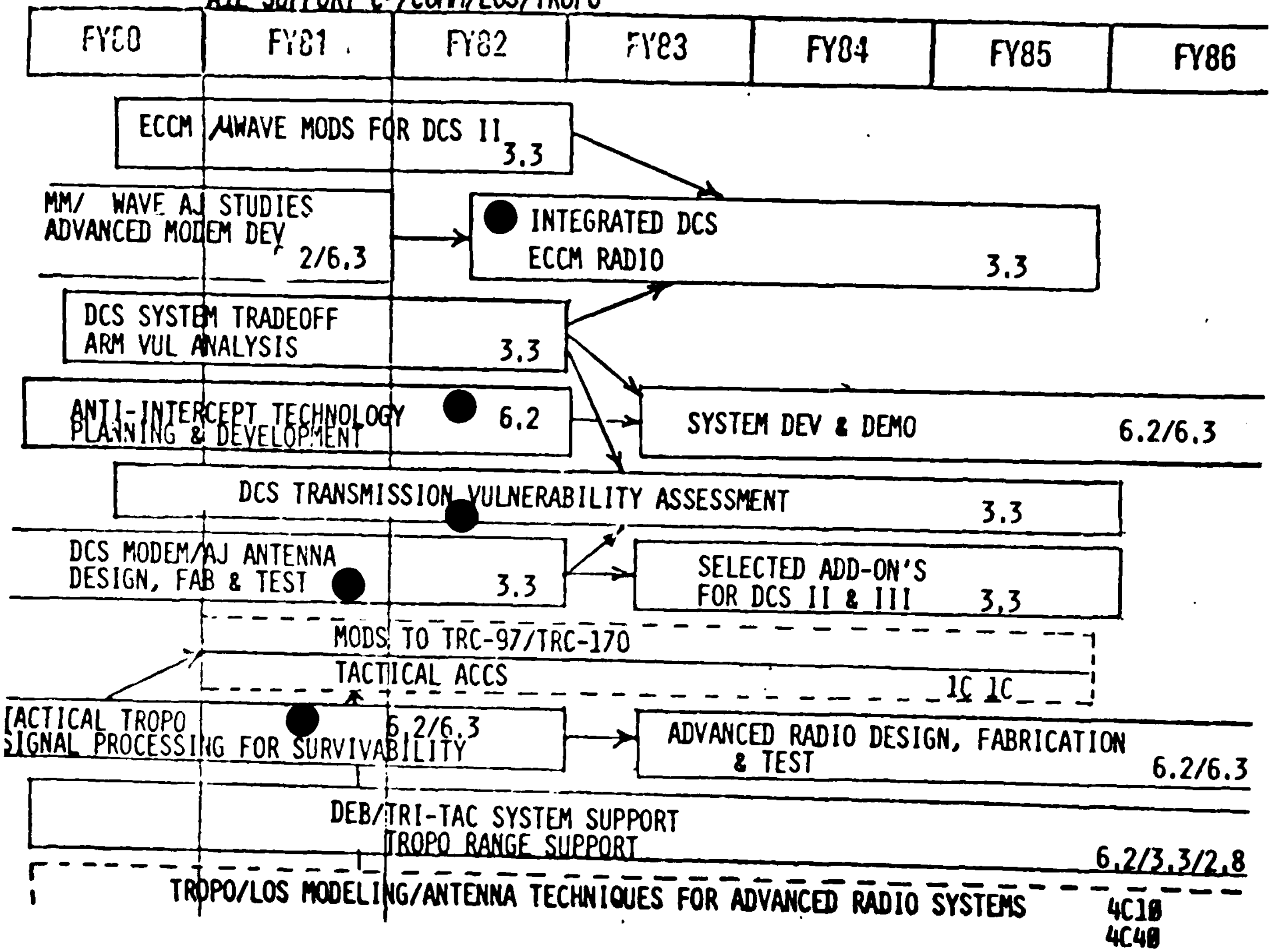
ESTIMATED FUNDING: FY80-83 (IN THOUSANDS)
$11,616

MICROWAVE & TROPOSCATTER TRANSMISSION



RADC TPO 1C³

THRUST: AJE SUPPORT C³/COMM/LOS/TROPO



SYSTEM TIMING & SYNCHRONIZATION

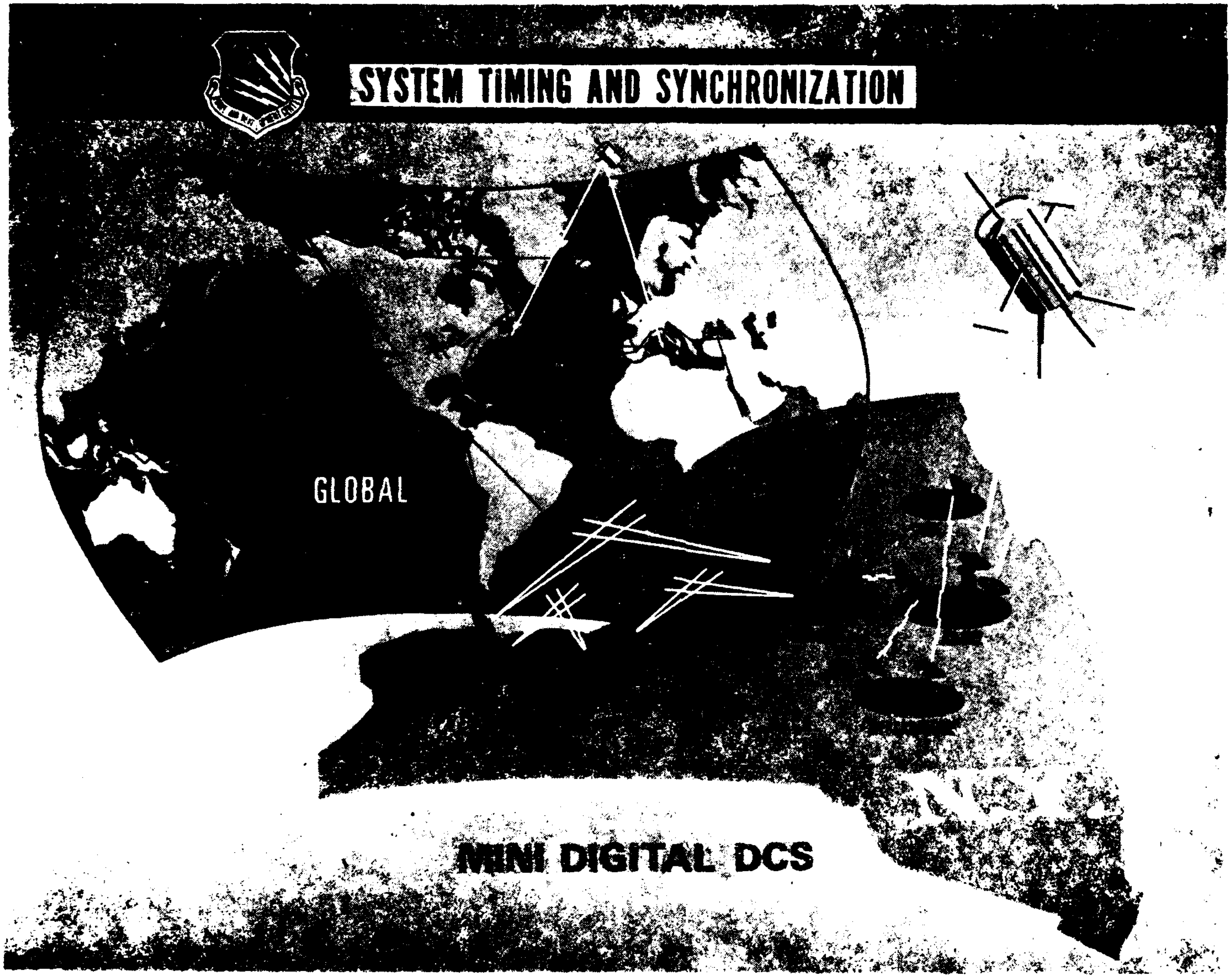
PROGRAM GOALS

DEVELOP TIMING SUBSYSTEMS REQUIRED FOR FUTURE DIGITAL TRANSMISSION SYSTEMS

TECHNICAL AREAS

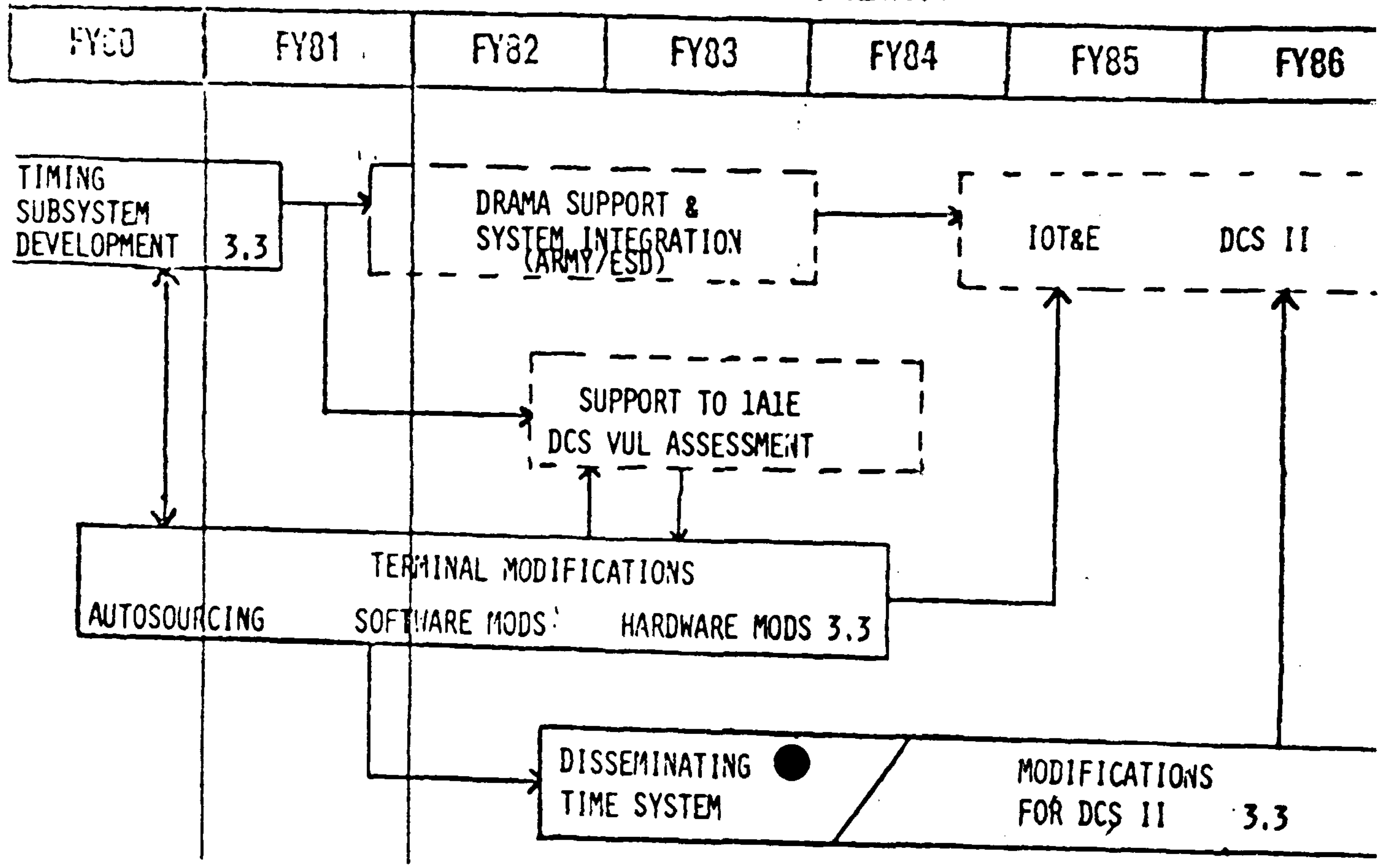
- DEVELOPMENT, TESTING & SELECTION OF TIMING TECHNIQUES
- ACCURATE TIME REFERENCES & TRANSFER TECHNIQUES

ESTIMATED FUNDING: FY80-83 (IN THOUSANDS)
$2,175


SYSTEM TIMING AND SYNCHRONIZATION
GLOBAL
MINI DIGITAL DCS

RADC TPO 1A/SUPPORT C^3

THRUST: 1F/COMMUNICATION SYSTEM TIMING & SYNCHRONIZATION



SUB-UHF COMMUNICATIONS (HF/VLF)

PROGRAM GOALS

PROVIDE SECURE, RELIABLE, LONG RANGE STRATEGIC COMMAND & CONTROL COMMUNICATIONS

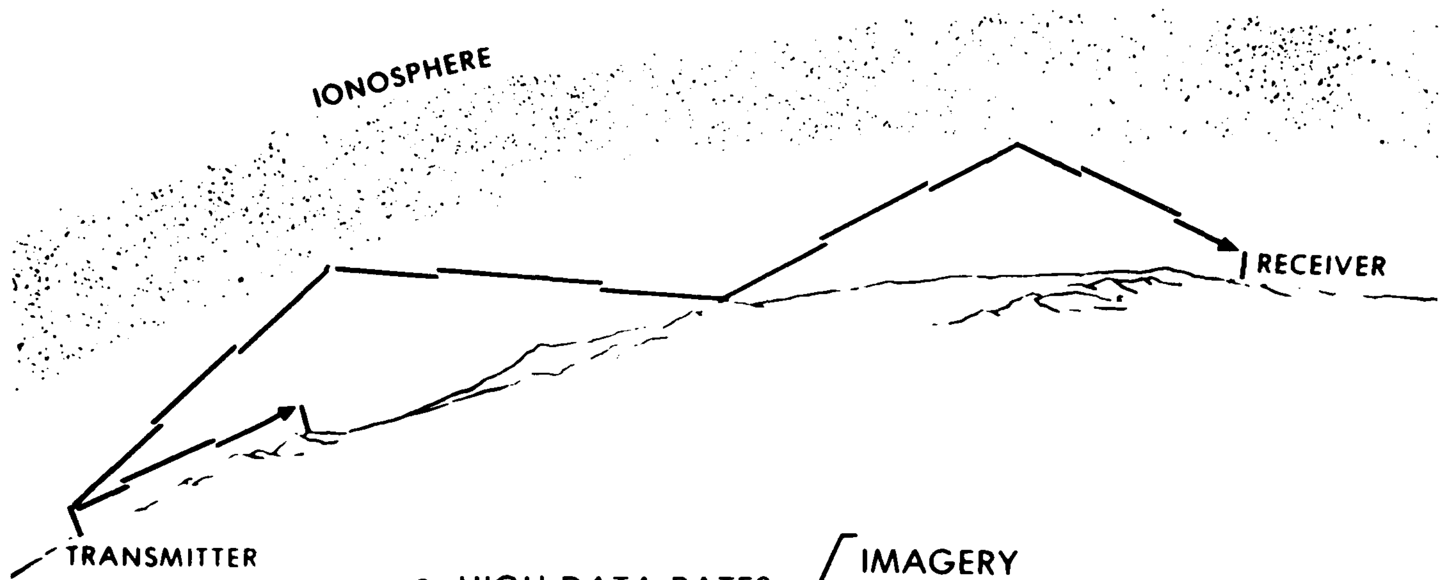
TECHNICAL AREAS

- BANDWIDTH EFFICIENT WAVEFORMS
- CHANNEL EQUALIZATION
- SPATIAL PROCESSING
- ADAPTIVE PROCESSING

ESTIMATED FUNDING FY80-83 (IN THOUSANDS)

$21,231

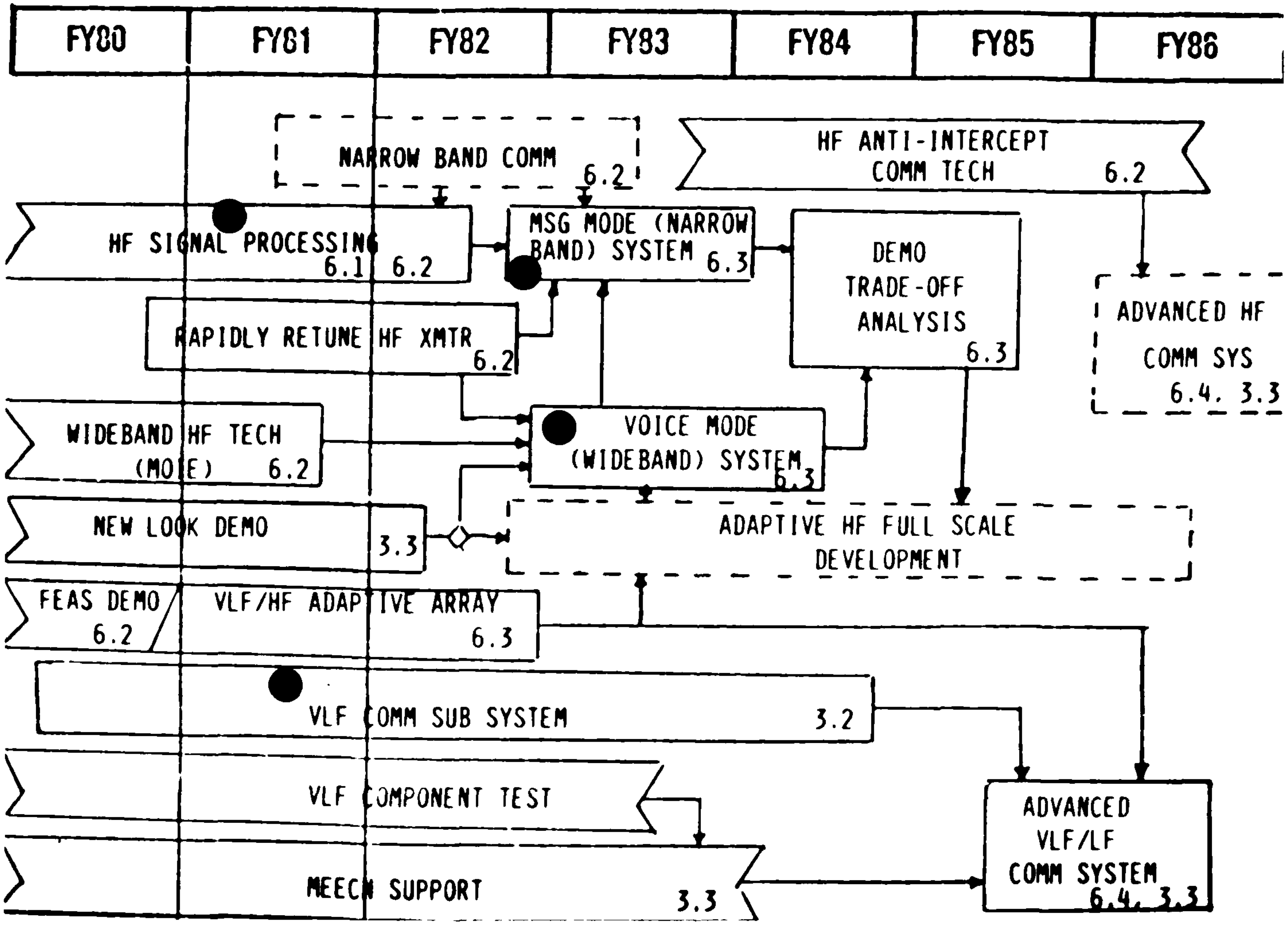
HIGH FREQUENCY RADIO COMMUNICATIONS



- HIGH DATA RATES
  - IMAGERY
  - DIGITAL VOICE
- ANTI-JAM
  - ANTENNA PROCESSING
  - WAVEFORM PROCESSING
- SYSTEM UPGRADE

RADC TPO 1. C^3

THRUST: B.1. STRATEGIC C^3/SUB UHF COMMUNICATIONS



OPTICAL COMMUNICATIONS

PROGRAM GOALS

APPLY OPTICAL COMMUNICATIONS TO REDUCE RELIANCE OF AF C^3I SYSTEMS ON COPPER CONDUCTOR CABLE TO REDUCE WEIGHT & COST, & DECREASE EMITTER OPERATIONS CENTER VULNERABILITY

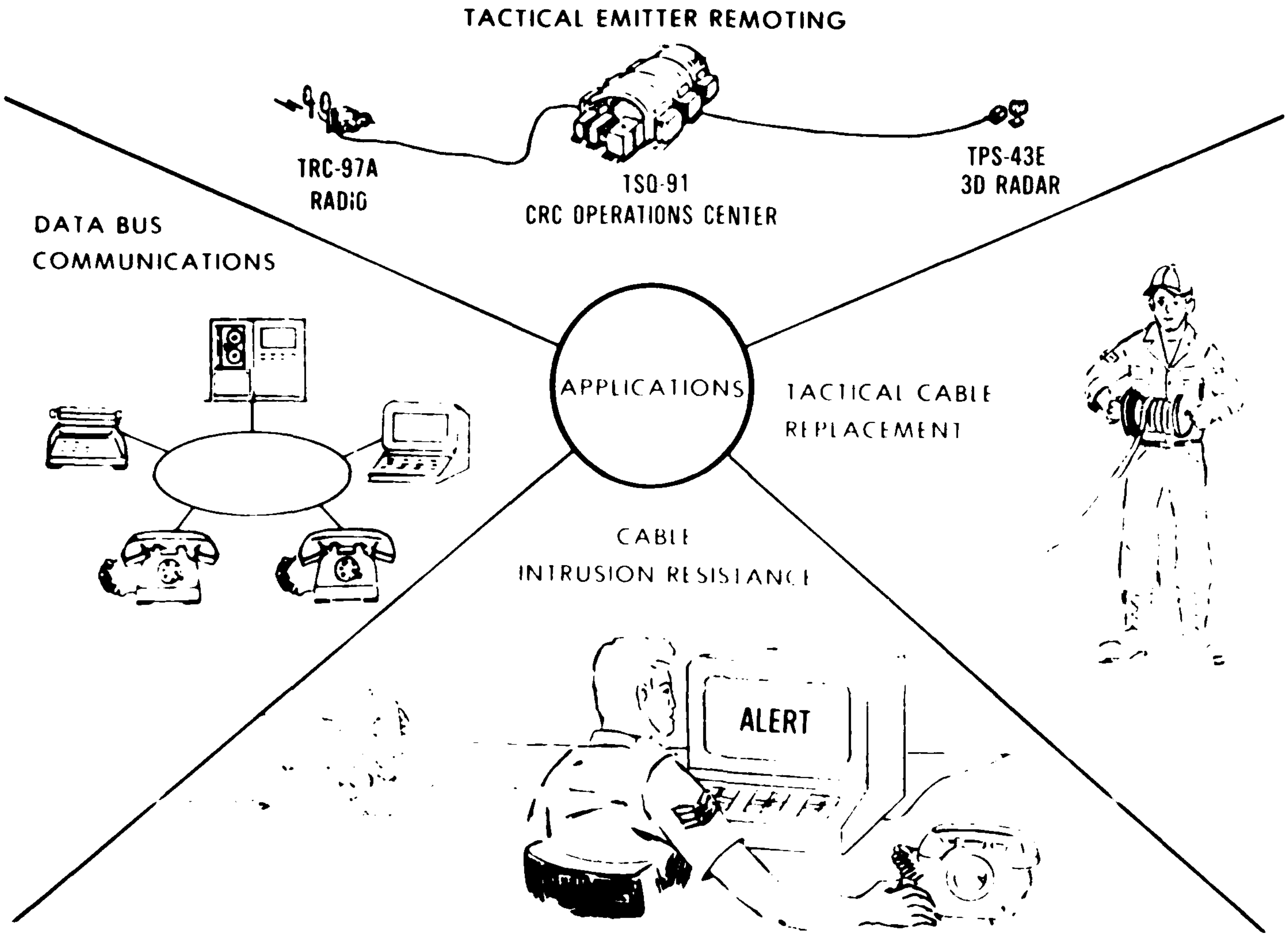
TECHNICAL AREAS:

- FIBER OPTICS
- ATMOSPHERIC OPTICS
- MULTIPLEXING
- BUS SYSTEMS

ESTIMATED FUNDING: FY80-83 (IN THOUSANDS)

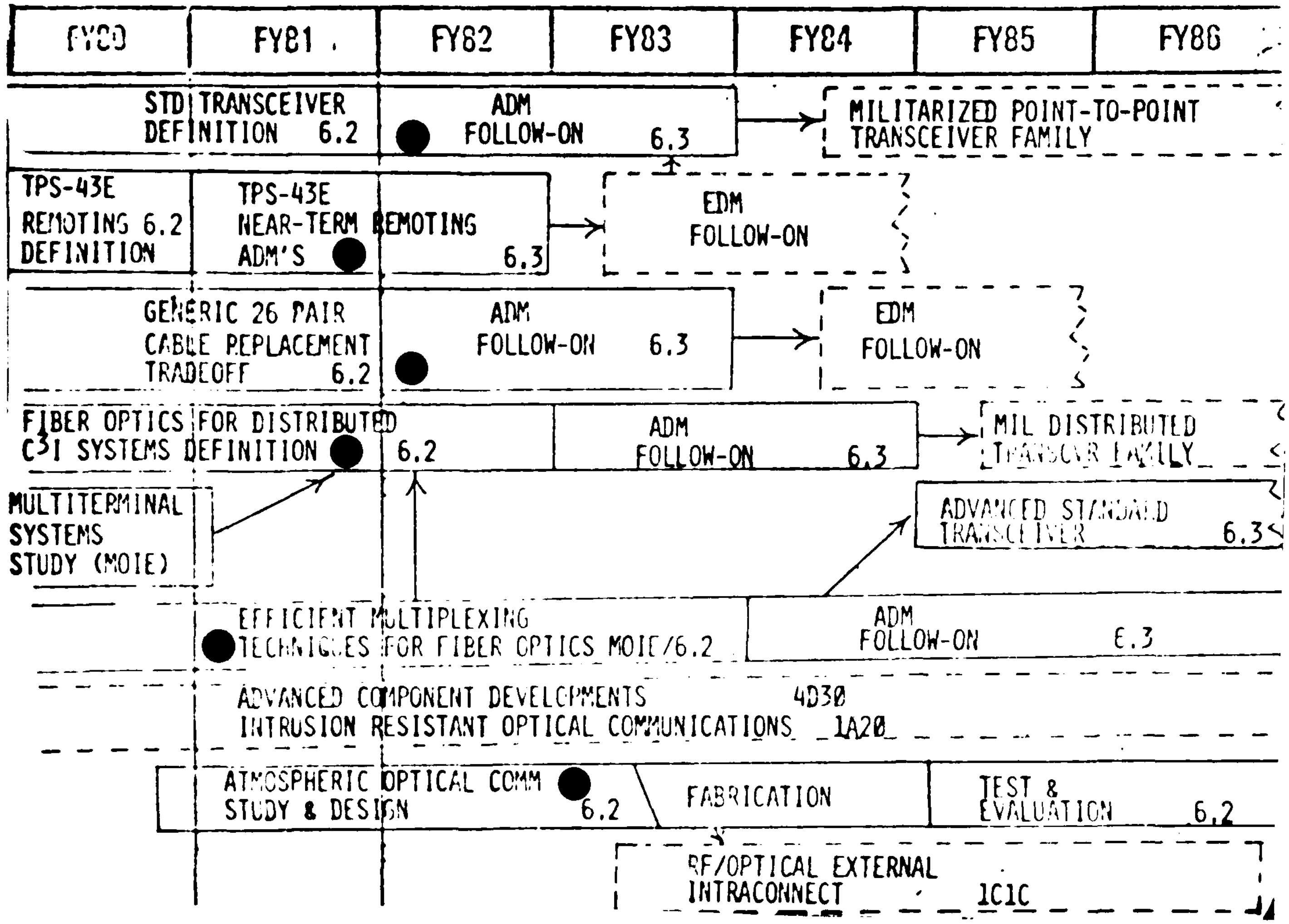
$1,982

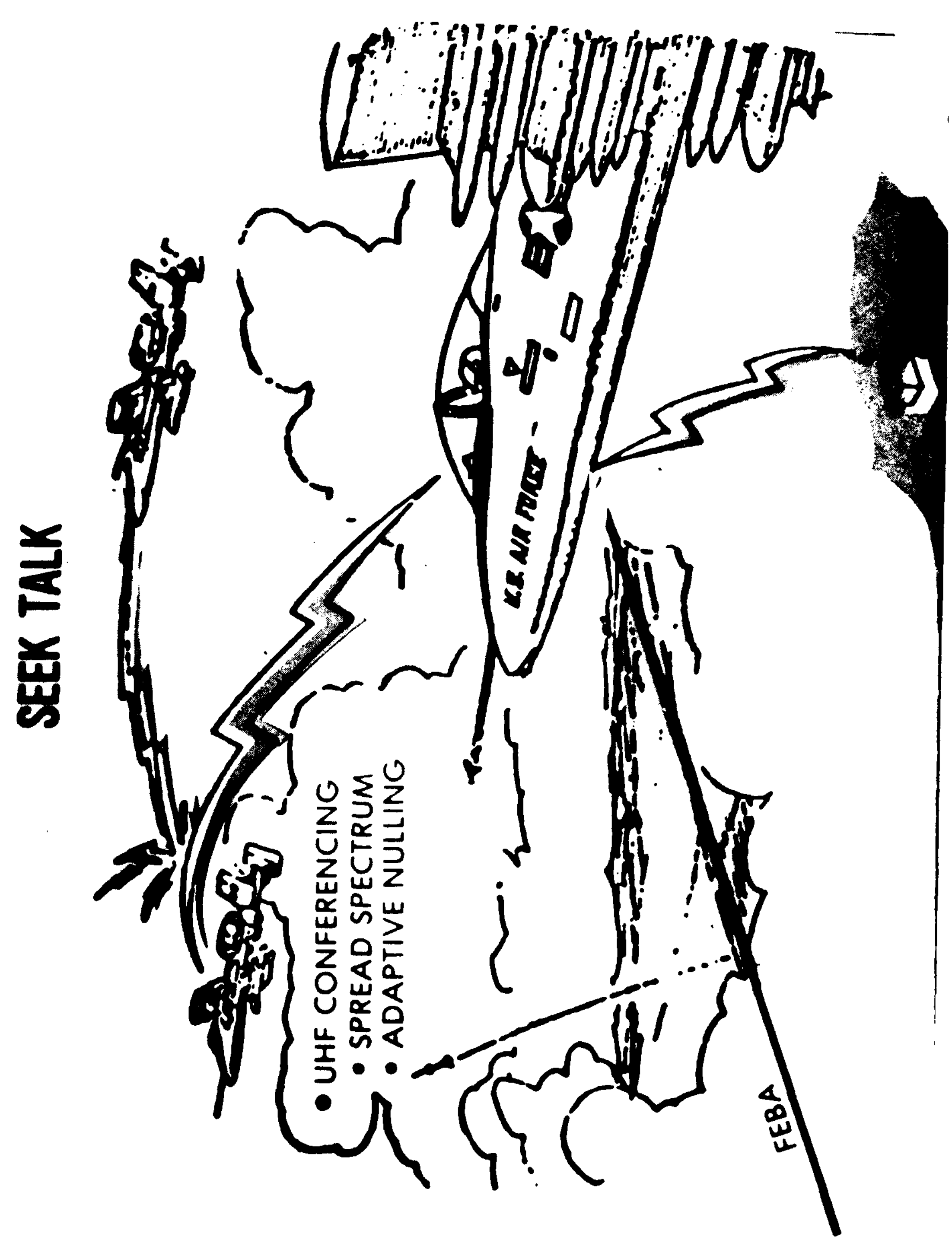
FIBER OPTICS C³I APPLICATIONS



1C/TACTICAL C^3

THRUST: 1A/COMMUNICATIONS OPTICAL COMMUNICATIONS




SEEK TALK
• UHF CONFERENCING
• SPREAD SPECTRUM
• ADAPTIVE NULLING
FEBA
U.S. AIR FORCE

DISTRIBUTED C^3

PROGRAM GOALS

- STANDARDIZE WIDEBAND COMM SUBSYSTEM/ARCHITECTURE FOR C^2 CENTER DEVELOPMENT/ACQUISITION/OPERATION
- IMPROVE INTER-CENTER COMM SYSTEM SURVIVABILITY & ABILITY TO SUPPORT DISTRIBUTED PROCESSING

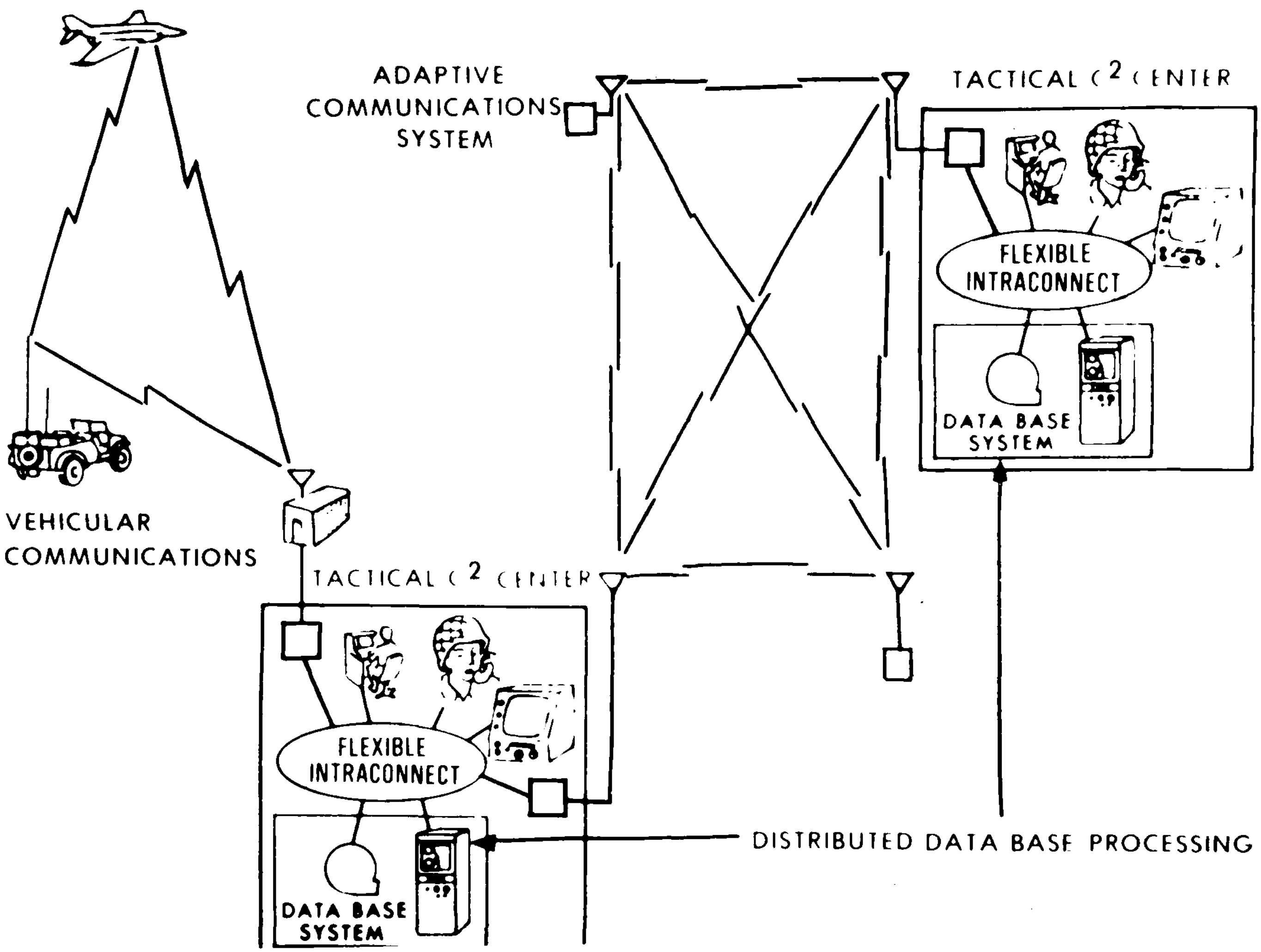
TECHNICAL AREAS

- MULTIPLEX/BUS COMMUNICATIONS
- PACKET COMMUNICATIONS
- SYSTEM CONTROL
- ADAPTIVE COMMUNICATIONS

ESTIMATED FUNDING: FY 80-83 (IN THOUSANDS)

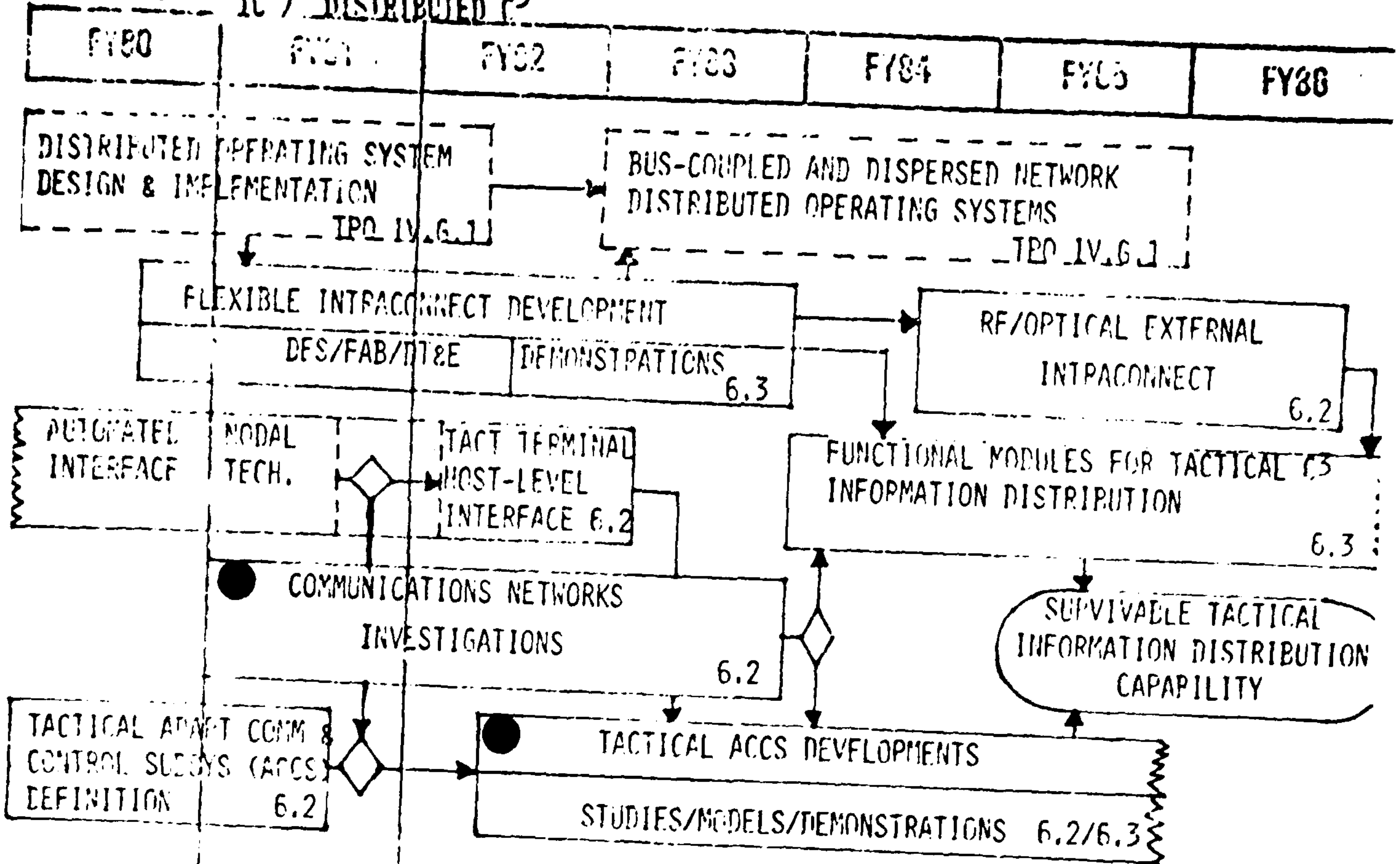
$14,758

DISTRIBUTED TACTICAL C³



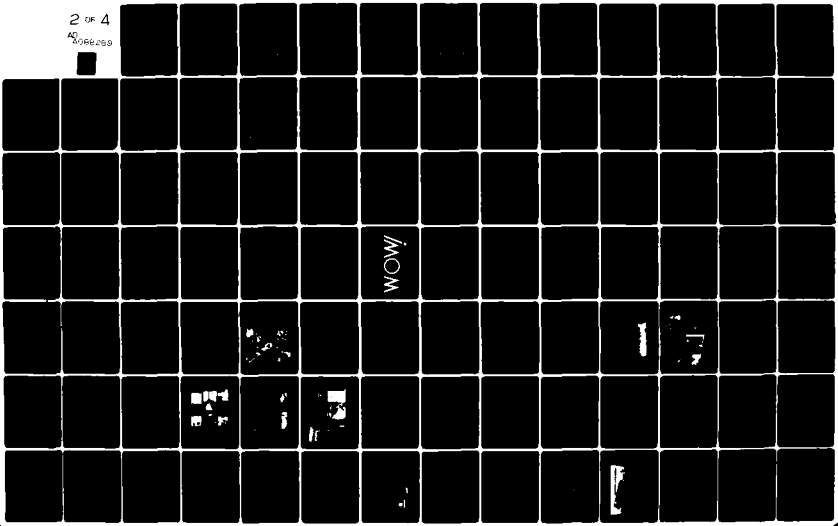
RADC TPO THRUST: 1C/TACTICAL C^3

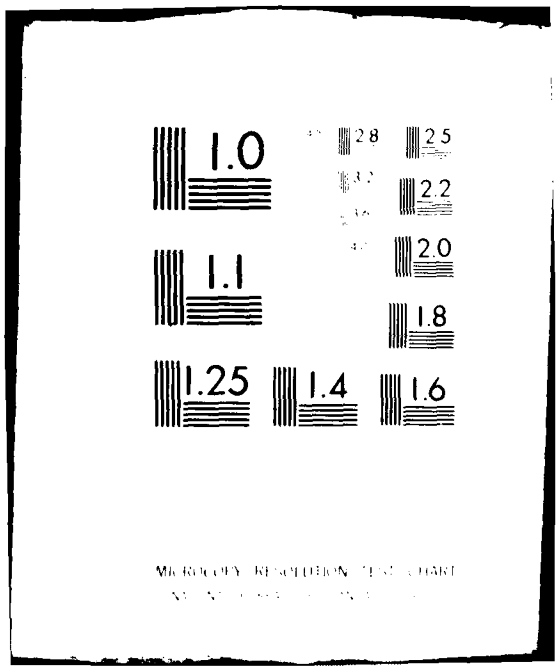
1C / DISTRIBUTED C^3



AD-A088 289 ROME AIR DEVELOPMENT CENTER GRIFFISS AFB NY F/G 5/1
INDUSTRY LOOKS AT RADC - 1980. VOLUME I.(U)
1980
UNCLASSIFIED RADC-TR-80-195-VOL-1 NL

2 OF 4
AD A088289




1.0
2.8
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

COMMAND CONTROL COMMUNICATIONS COUNTERMEASURES (C^3CM)

PROGRAM GOALS

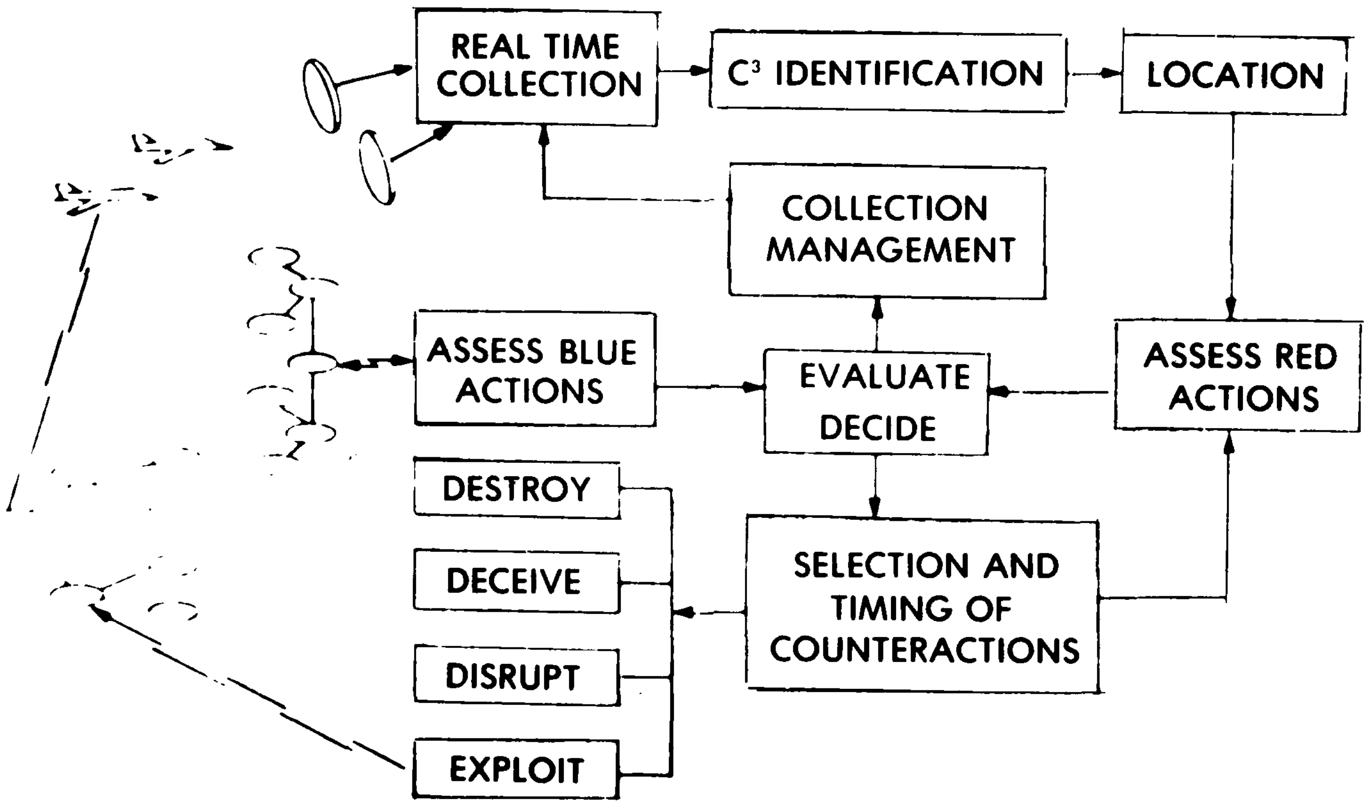
- EXPLOIT HIGH RATE, HIGH ACCURACY SENSORS
- BROAD BASE DECEPTION PROGRAM

TECHNICAL AREAS

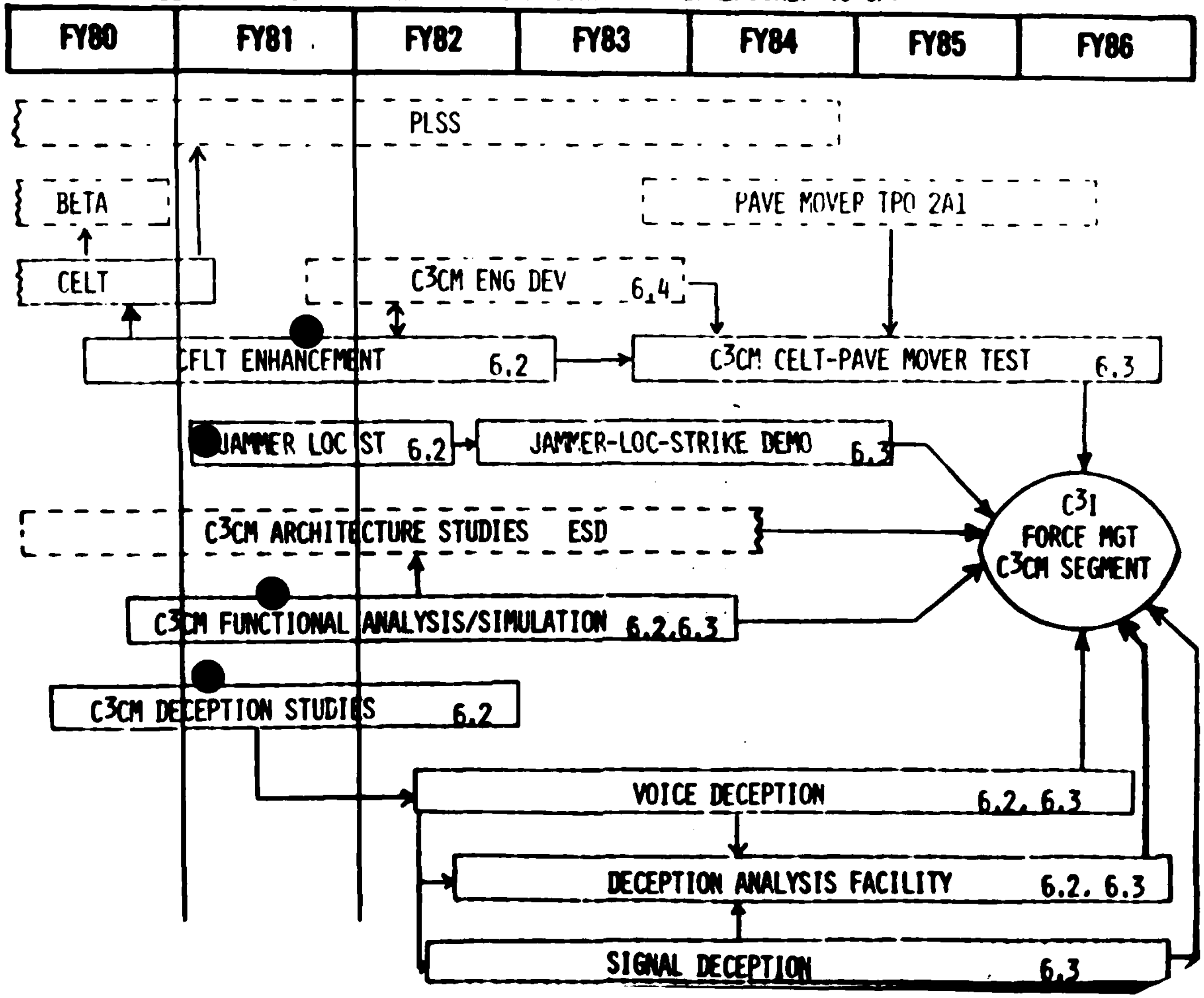
- CELT ENHANCEMENT/DATA COLLECTION
- C^3CM-C^3 FUNCTIONAL ANALYSIS
- JAMMER LOCATION
- VOICE DECEPTION
- COMMUNICATION-WEAPON LINK DECEPTION
- NAVIGATION DECEPTION

ESTIMATED FUNDING: FY 80-83 (IN THOUSANDS)
$16,715

C²CM SYSTEM CONCEPT (NEW INITIATIVE)



THRUST: IDO COMMAND CONTROL COMMUNICATIONS COUNTERMEASURES (C^3CM)



ADAPTIVE PROCESSING FOR COMM

PROGRAM GOALS

ADVANCE THE STATE-OF-THE-ART IN ADAPTIVE SPATIAL PROCESSING TO SATISFY ECCM REQUIREMENTS OF AF SYSTEMS AT AN AFFORDABLE COST

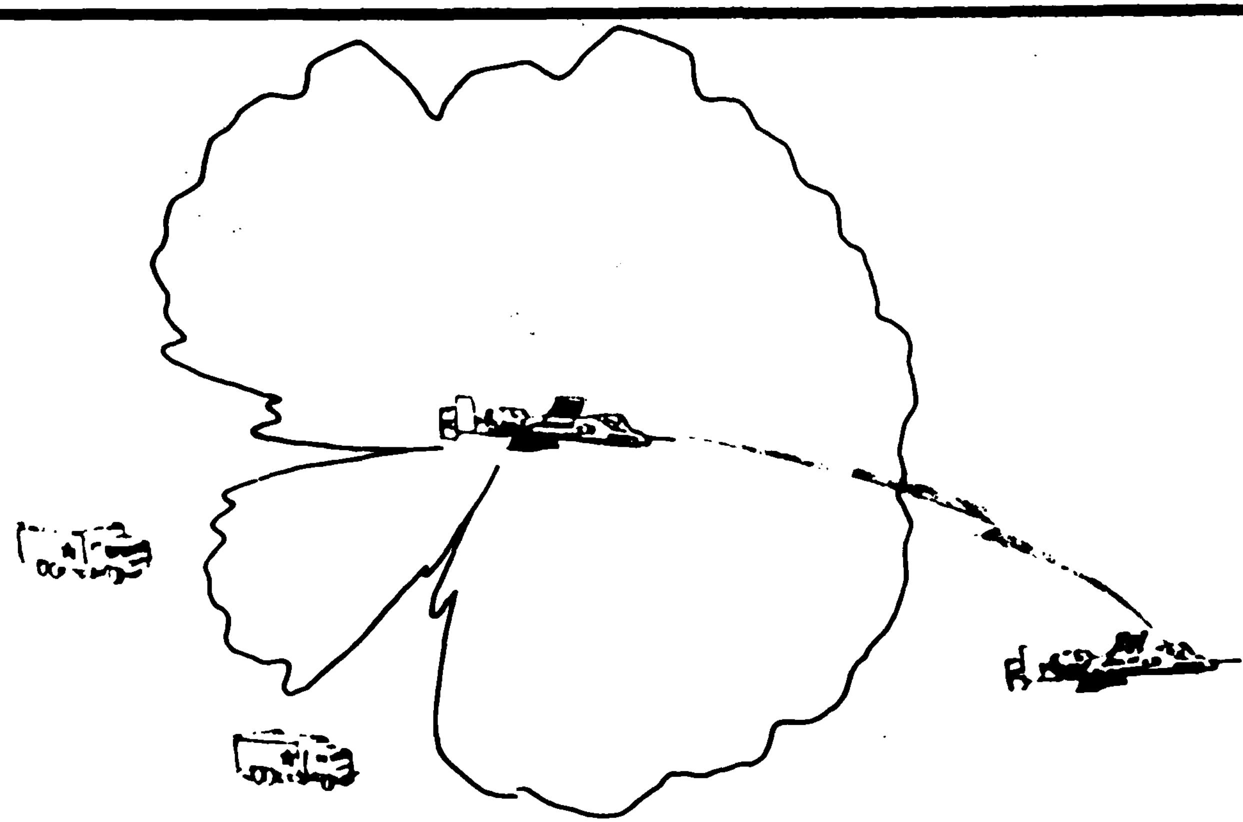
TECHNICAL AREAS

- ADAPTIVE ALGORITHMS
- ADAPTIVE PROCESSORS
- TEST METHODOLOGY OF ADAPTIVE ARRAYS

ESTIMATED FUNDING: FY80-83 (IN THOUSANDS)

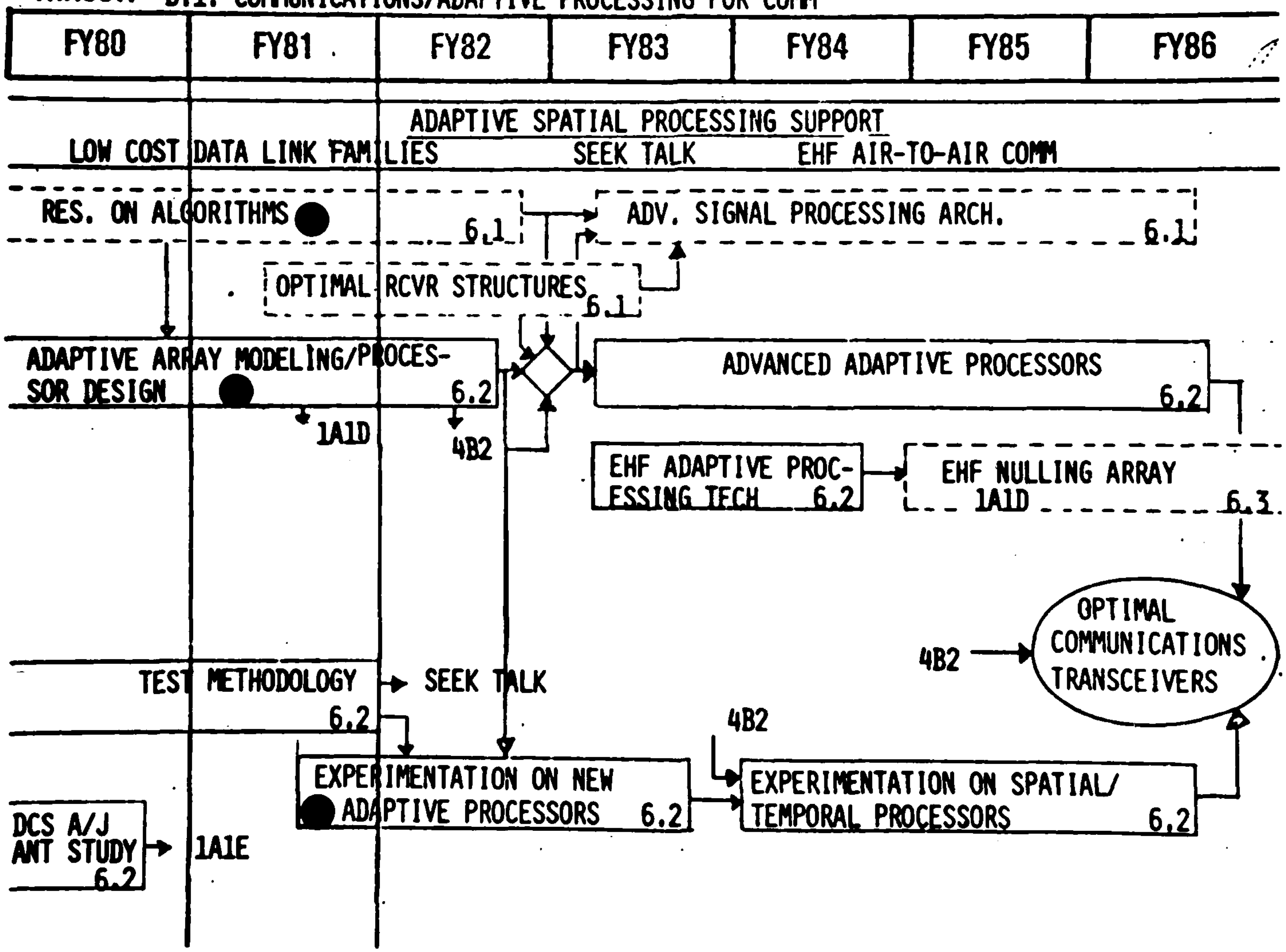
$2,754

ADAPTIVE ANTENNA NULLING



RADC TPO 4. TECHNOLOGY

THRUST: B.1. COMMUNICATIONS/ADAPTIVE PROCESSING FOR COMM



ADVANCED SURVIVABLE COMMUNICATIONS TECHNOLOGY

PROGRAM GOALS

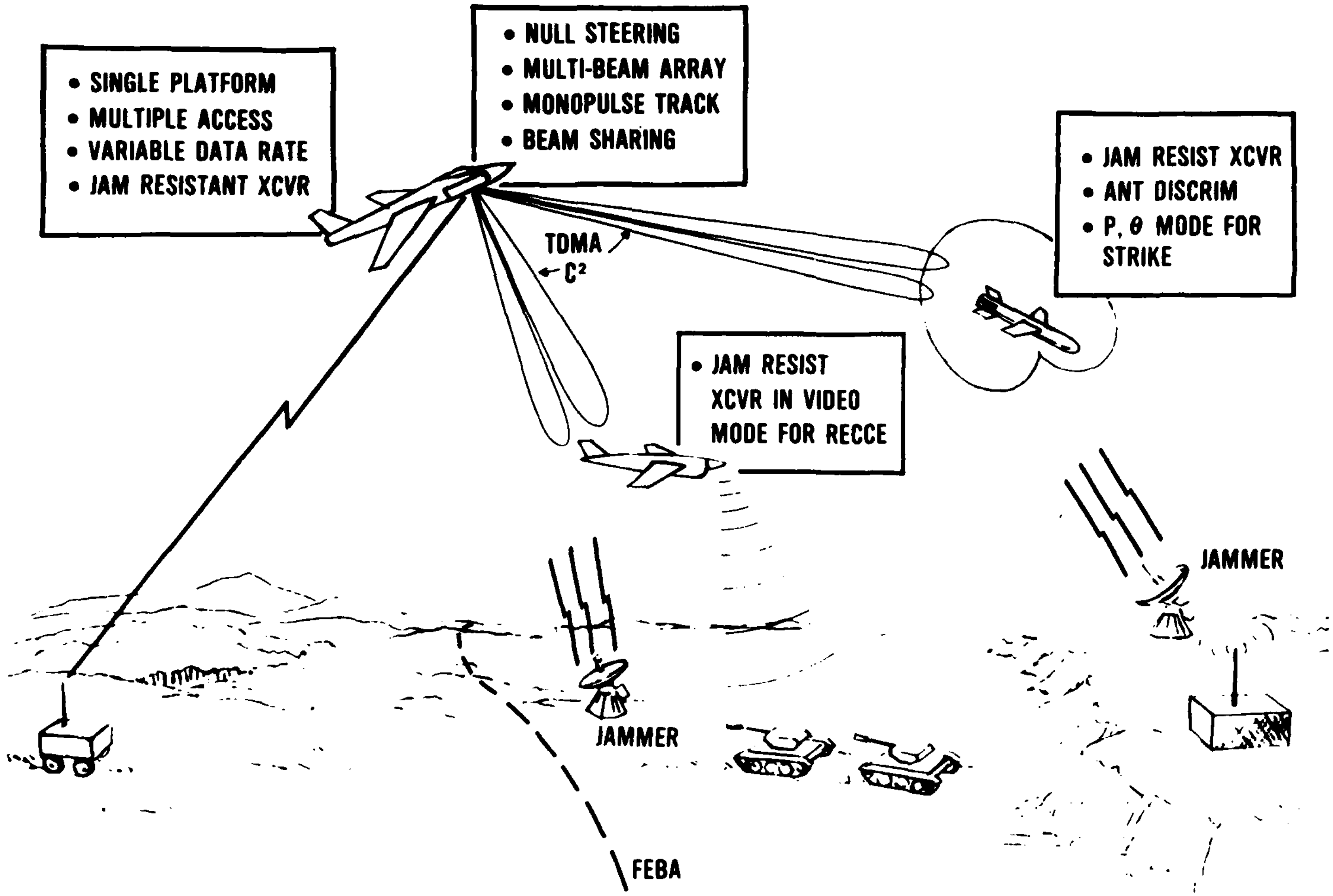
ESTABLISH TECHNOLOGY BASE TO INSURE HIGHLY SURVIVABLE TACTICAL COMMAND, CONTROL & COMMUNICATIONS INFORMATION TRANSFER CAPABILITIES IN LIGHT OF PROJECTED THREAT

TECHNICAL AREAS

- SPREAD SPECTRUM
- ADAPTIVE INTERFERENCE REJECTION
- LOW PROBABILITY OF INTERCEPT
- PROGRAMMABLE DEVICES/SIGNAL PROCESSORS

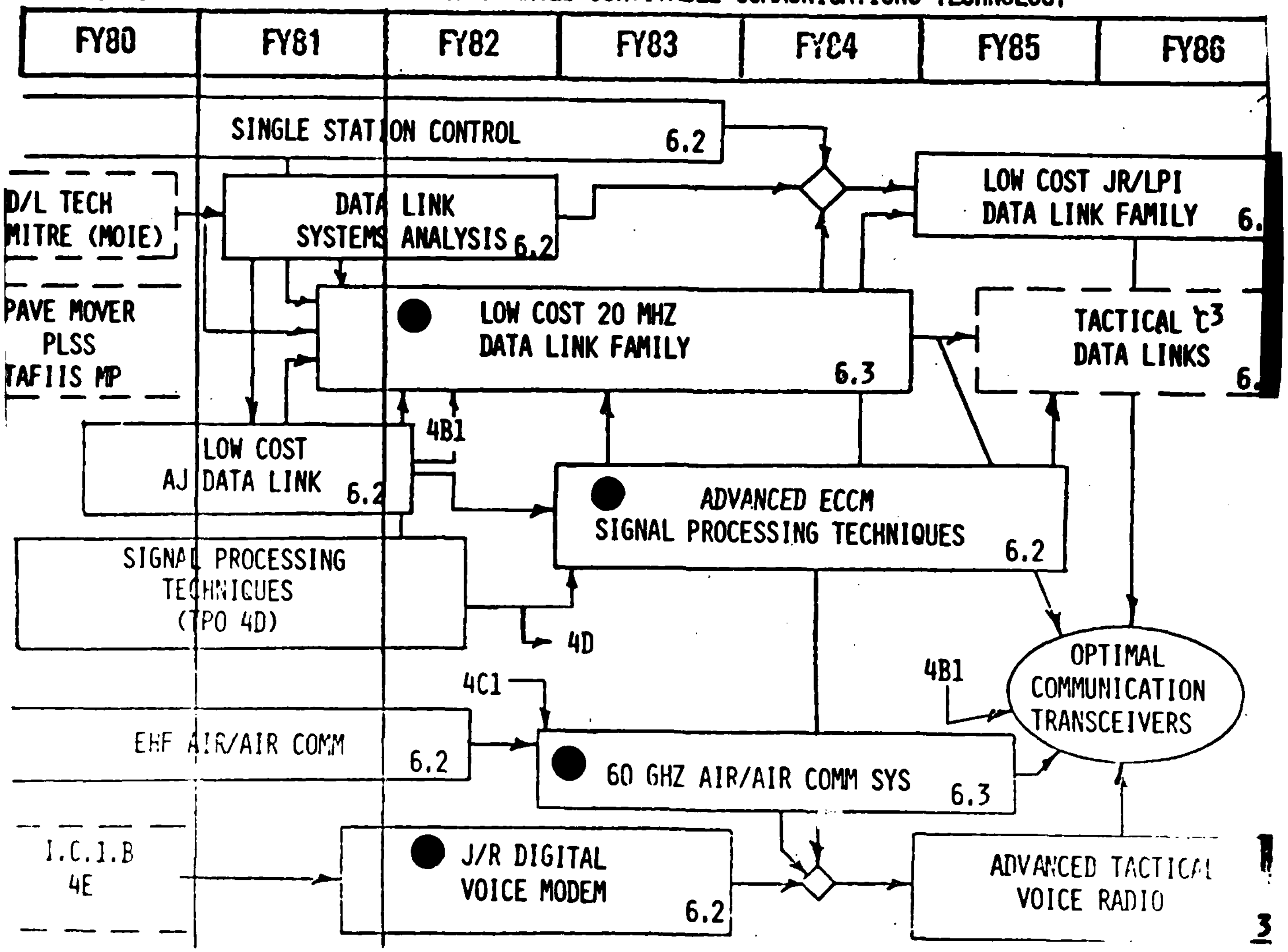
ESTIMATED FUNDING: FY80-83 (IN THOUSANDS)
$6,786

LOW COST JAM RESISTANT DATA LINK



RADC TPO 4 - TECHNOLOGY

THRUST: B2 - COMMUNICATIONS/ADVANCED SURVIVABLE COMMUNICATIONS TECHNOLOGY



C^3 SYSTEM DESIGN & ANALYSIS

PROGRAM GOALS

- EVOLVE NEW C^2 COMMUNICATIONS CONCEPTS/TECHNIQUES TO ENHANCE EXISTING SYSTEMS
- EVALUATION OF ADVANCED SYSTEM TECHNIQUES/CONCEPTS

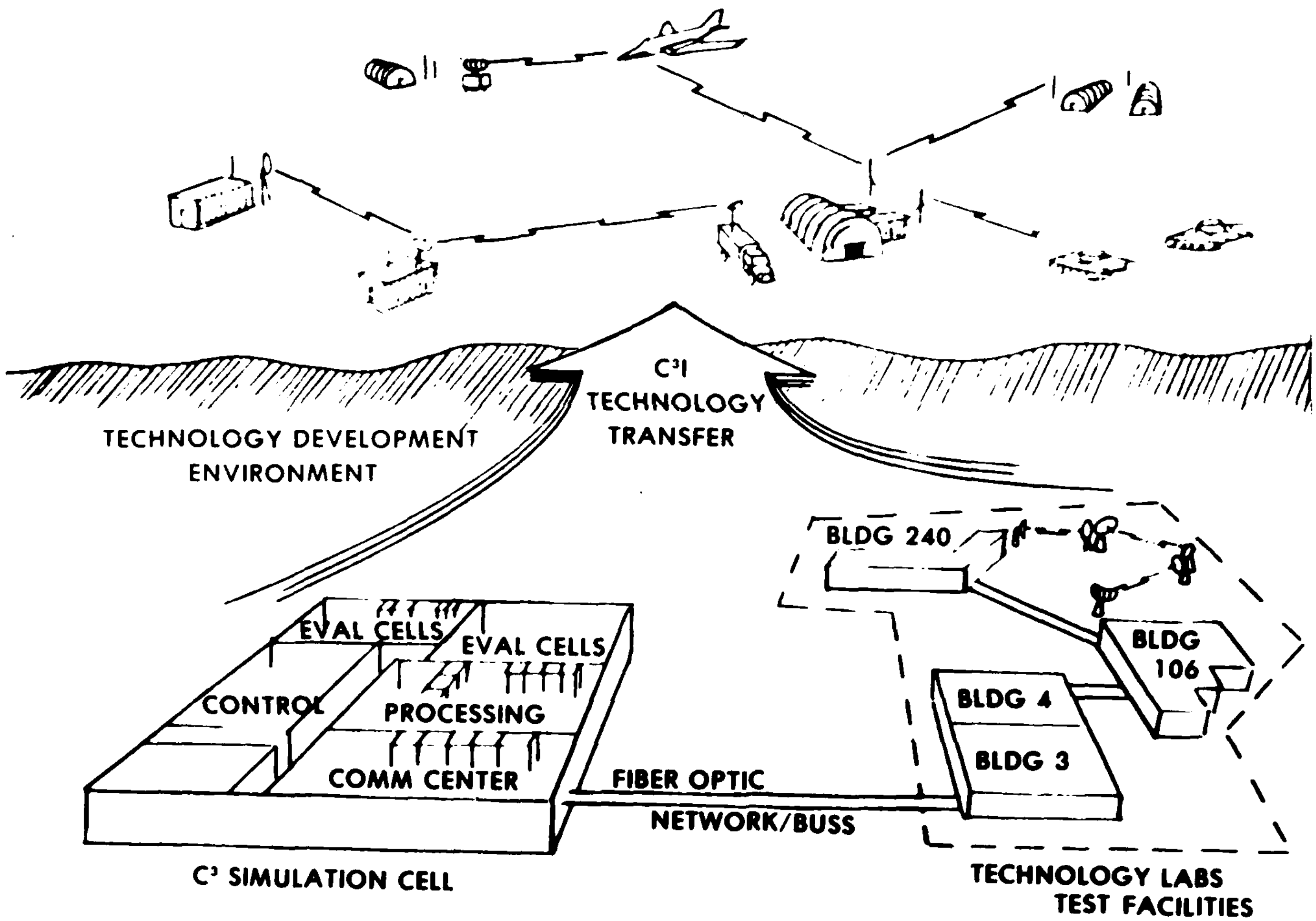
TECHNICAL AREAS

- COMMUNICATIONS DISTRIBUTION
- INTERFACES
- PROTOCOLS
- SIMULATION

ESTIMATED FUNDING: FY80-83 (IN THOUSANDS)

$7,419

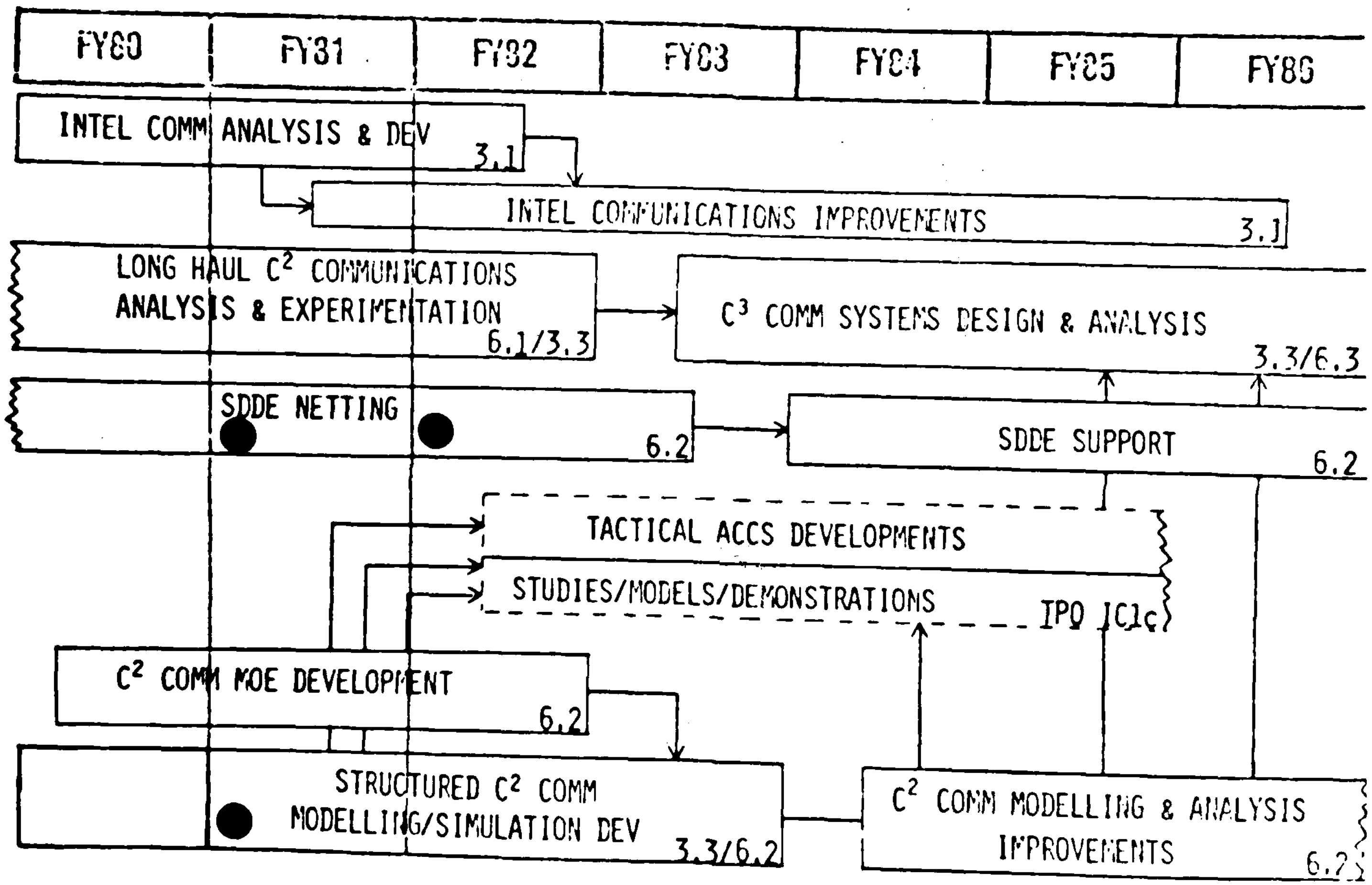
SODE



C³I
TECHNOLOGY
TRANSFER
TECHNOLOGY DEVELOPMENT
ENVIRONMENT
BLDG 240
EVAL CELLS
EVAL CELLS
CONTROL
PROCESSING
COMM CENTER
FIBER OPTIC
NETWORK/BUSS
BLDG 106
BLDG 4
BLDG 3
C³ SIMULATION CELL
TECHNOLOGY LABS
TEST FACILITIES

TPO/THRUST: 4B/COMMUNICATIONS

SUB-THRUST: 3/C^3 SYSTEM DESIGN & ANALYSIS



KEY PROGRAM MANAGERS

SUPPORT C^3	—	H. CROWLEY, RADC/DC	x3041
STRATEGIC C^3	—	L. DOUBLEDAY, RADC/DCC	x3171
TACTICAL C^3	—	J. KELLY, RADC/DCL	x7667
C^3 COUNTERMEASURES	—	D. ZULCH, RADC/DCI	x4175
COMMUNICATIONS TECHNOLOGY	—	A. SNYDER, RADC/DCC	x3171

ELECTROMAGNETICS

LT COL WILLIAM BASCHNAGEL

__TPO/THRUST__: 4 TECHNOLOGY/4C ELECTROMAGNETICS

__OBJECTIVE__: BETTER PERFORMANCE OF AIR FORCE C^3 SYSTEMS THROUGH IMPROVEMENTS IN ELECTROMAGNETICS TECHNOLOGY (ANTENNAS, EM SCATTERING, AND PROPAGATION)

__GOALS__: IMPROVED ANTENNAS AND RF COMPONENTS
TARGET, CLUTTER, AND MULTIPATH MODELS FOR ADVANCED COMM & SURV SYSTEMS
NEW RF PROPAGATION TECHNOLOGY FOR GREATER C^3 SYSTEM CAPABILITY

__TECHNICAL APPROACH__: LIGHTWEIGHT ARRAY TECHNOLOGY FOR LARGE AIRCRAFT ANTENNAS
EHF LOW PROFILE AND CONFORMAL ANTENNAS
DUAL FREQUENCY BAND ARRAYS, ADAPTIVE SUBARRAY NULLING
TAPPED DELAY SAW CORRELATORS, NOVEL RF PHASOR TECHNOLOGY
INCLUSION OF TERRAIN GRADIENTS AND SCREENING IN CLUTTER/MULTIPATH PREDICTIVE MODELING
CLOUD ATTENUATION AND BEYOND LOS DIFFRACTION MEASUREMENTS
PREDICTION OF PROPAGATION-CAUSED OUTAGE OF OTH RADAR

TPO/THRUST: 4 TECHNOLOGY/4C ELECTROMAGNETICS

SUB/THRUST: 4C10 ANTENNAS

PROGRAM GOALS:

- DEVELOP ADVANCED ANTENNA TECHNOLOGY FOR GROUND BASED, SPACE BASED AND AIRCRAFT APPLICATIONS

TECHNICAL AREAS:

- DETERMINISTIC AND ADAPTIVE RADIATION PATTERN CONTROL
- LOW PROFILE AND CONFORMAL AIRCRAFT ANTENNAS
- LONG WAVE ANTENNAS

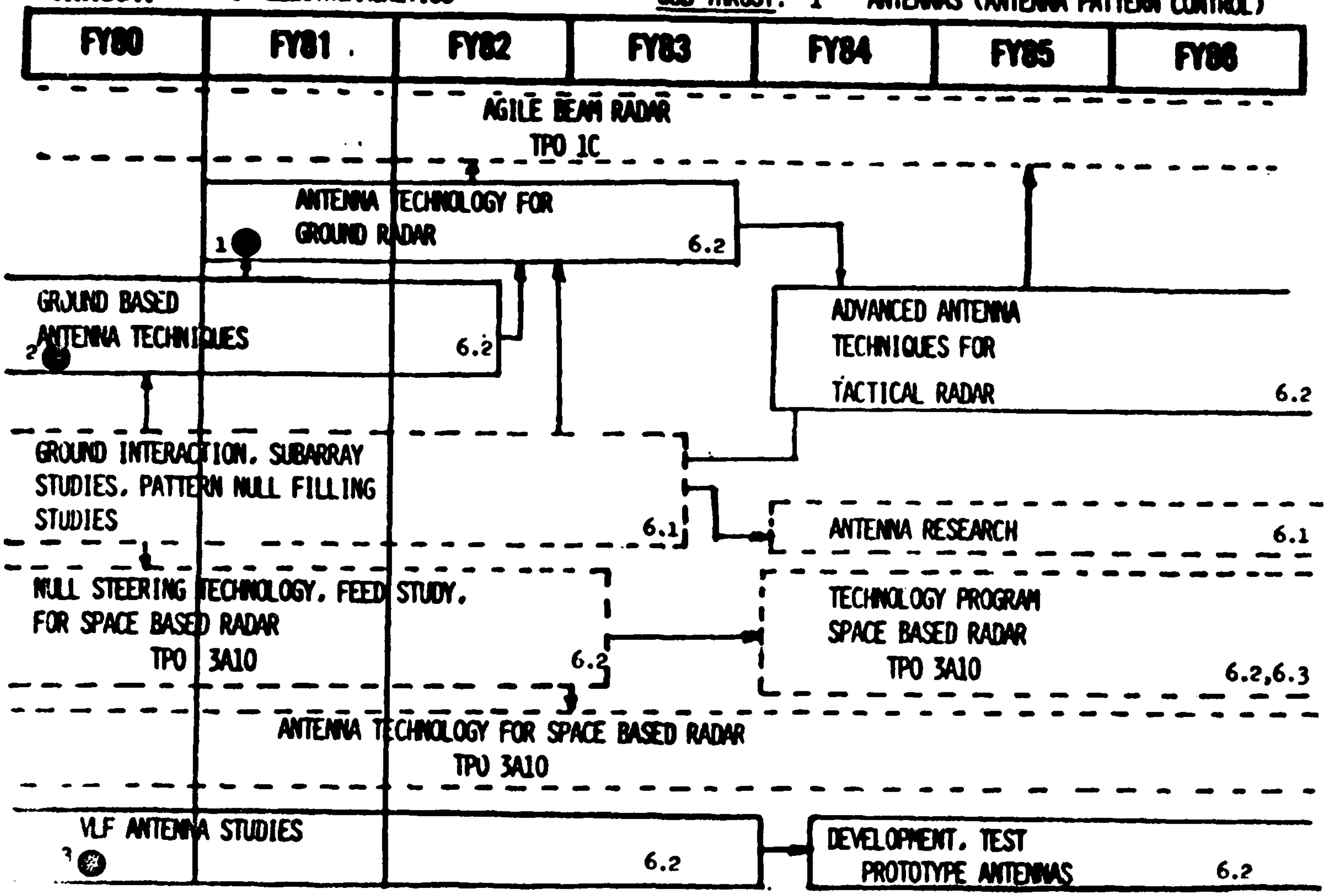
PROGRAMS:

61102F	BASIC RESEARCH IN ANTENNA FEED AND PATTERN CONTROL
62702F	EXPLORATORY DEVELOPMENT - ANTENNAS AND ARRAYS
63431F	LOW PROFILE ANTENNAS FOR SATCOM

RADC TPO 4. TECHNOLOGY

THRUST: 4C ELECTROMAGNETICS

SUB-THRUST: 1 ANTENNAS (ANTENNA PATTERN CONTROL)



TPO/THRUST: 4C ELECTROMAGNETICS

SUB/THRUST: 4C10 ANTENNAS (ANTENNA PATTERN CONTROL)

EFFORT BLOCK TITLE: ANTENNA TECHNOLOGY FOR GROUND RADAR

OBJECTIVE: DEVELOP NEW ANTENNA TECHNOLOGY WITH IMPROVED ECCM FEATURES FOR GROUND BASED RADAR

TECHNICAL APPROACH: CONSTRAINED FEED SUBARRAY
DUAL BAND ARRAY FOR THE RADAR
ADAPTIVE SPACE FED ANTENNA SYSTEM
WIDE BAND LENS AND SUBARRAY STUDIES

PAYOFF: ANTENNA TECHNIQUES FOR RADAR SYSTEMS

LOW COST, HIGH PERFORMANCE RADAR SYSTEMS

THRUST: 4C ELECTROMAGNETICS

SUB/THRUST: 4C10 ANTENNAS

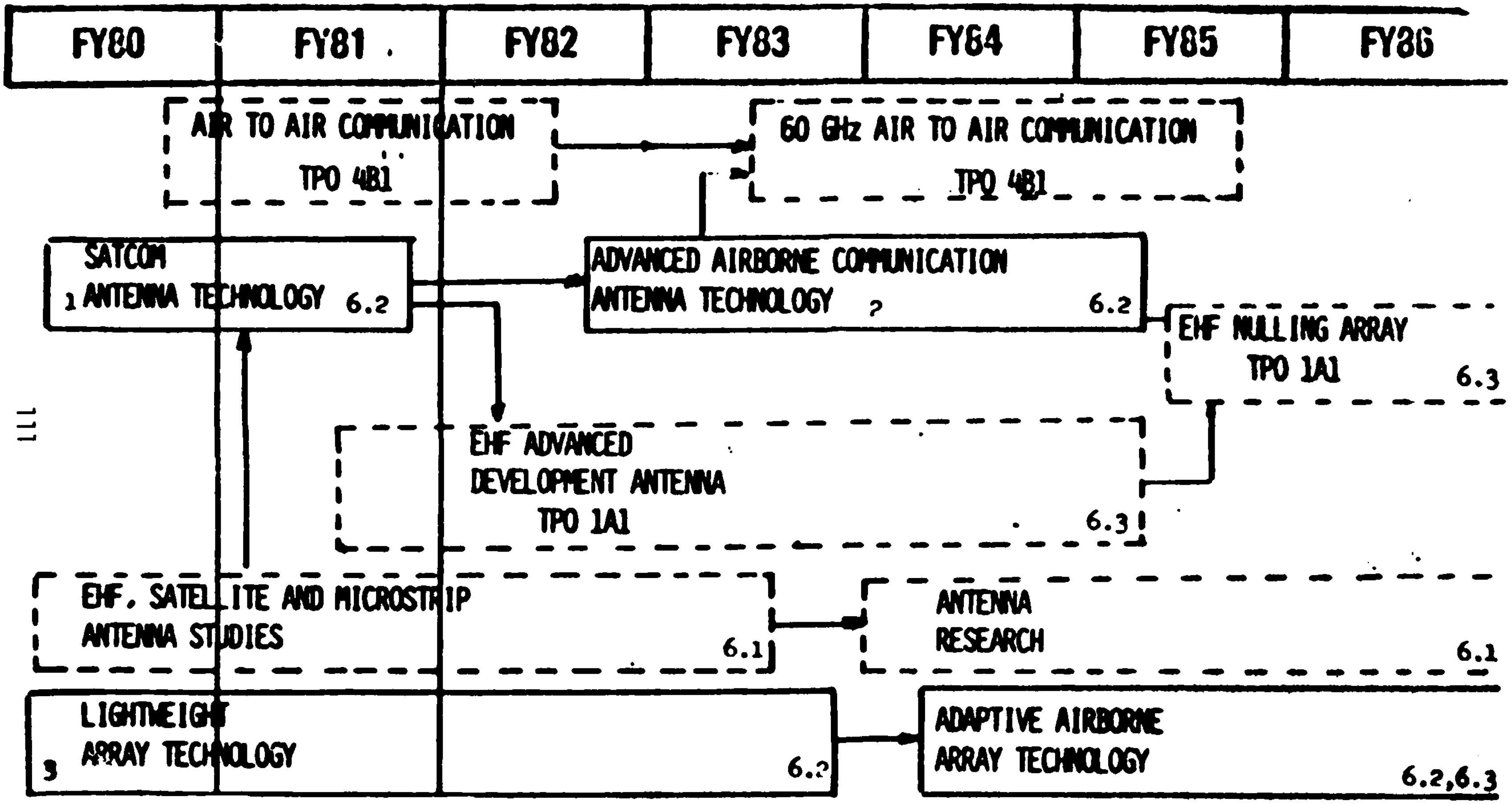
BLOCK TITLE: VLF ANTENNA STUDIES

OBJECTIVE: FURNISH AF C3 MISSION WITH NEW ANTENNA TECHNOLOGY FOR VLF EMERGENCY COMMUNICATIONS/JAM RESISTANT COMMUNICATION MODES

TECHNICAL APPROACH: EXAMINE RADIATION AND EFFICIENCY OF VLF LOOP AND GROUND BASED TE ANTENNAS. ANALYZE DISPERSIBLE ANTENNA AND POTENTIAL SUB-CUTOFF FREQUENCY ANTENNAS

PAY OFF: EXTENSION OF VLF COMMUNICATIONS RANGE, RELIABILITY, AND SURVIVABILITY

RADC TPO 4 TECHNOLOGY
THRUST: 4C ELECTROMAGNETICS SUB-THRUST: 1 ANTENNAS (CONFORMAL AND HEMI-SCAN)



TPO THRUST: 4C ELECTROMAGNETICS

SUB/THRUST: 4C10 ANTENNAS (CONFORMAL AND HEMISPHERICAL COVERAGE ANTENNAS)

BLOCK TITLE: ADVANCED AIRBORNE COMMUNICATIONS ANTENNA TECHNOLOGY

OBJECTIVE: DEVELOP LOW COST LIGHTWEIGHT CONFORMAL ARRAY TECHNOLOGY WITH ADVANCED ECCM FEATURES FOR SATELLITE COMMUNICATION

TECHNICAL APPROACH: EXTEND PRINTED CIRCUIT ARRAY TECHNOLOGY TO EHF FREQUENCIES. INVESTIGATE USE OF ADVANCED MEANS OF NULLING, SIDELOBE CONTROL AND MULTIPLE FREQUENCY OPERATION. DEVELOP 60 GHz ANTENNA TECHNIQUES

PAY OFF: SUBSTANTIAL INCREASE IN SATCOM AND AIR-AIR ANTENNA PERFORMANCE THROUGH WIDEBAND NULL STEERING AND MULTIPLE FREQUENCY FEEDS

<u>TPO/THRUST:</u> 4C ELECTROMAGNETICS

<u>SUB/THRUST:</u> 4C10 ANTENNAS (CONFORMAL AND HEMISPHERICAL COVERAGE ANTENNAS)

<u>EFFORT BLOCK TITLE:</u> LIGHTWEIGHT ARRAY TECHNOLOGY

<u>OBJECTIVE:</u> TO DEVELOP LIGHTWEIGHT HIGH PERFORMANCE ANTENNAS FOR AIRBORNE RADAR AND COMMUNICATIONS APPLICATIONS

<u>TECHNICAL APPROACH:</u> VERY HIGH GAIN PRINTED CIRCUIT ANTENNAS FOR SAC COMMUNICATIONS
ADAPTIVE LOW SIDELOBE ARRAY FOR ADVANCED SURVEILLANCE RADAR

<u>PAY OFF:</u> LOW COST, LIGHTWEIGHT AIRCRAFT ARRAYS WOULD GREATLY INCREASE THE RANGE AND STATION TIME OF AIRBORNE SYSTEMS IN COMPARISON WITH ROTATING FIXED BEAM ANTENNAS

TPO/THRUST: RADC TPO 4C ELECTROMAGNETICS

SUB/THRUST: 4C20 RF COMPONENTS

PROGRAM GOALS: DEVELOP LOW COST, COMPACT RF COMPONENTS FOR C^3I SYSTEMS

TECHNICAL AREAS:

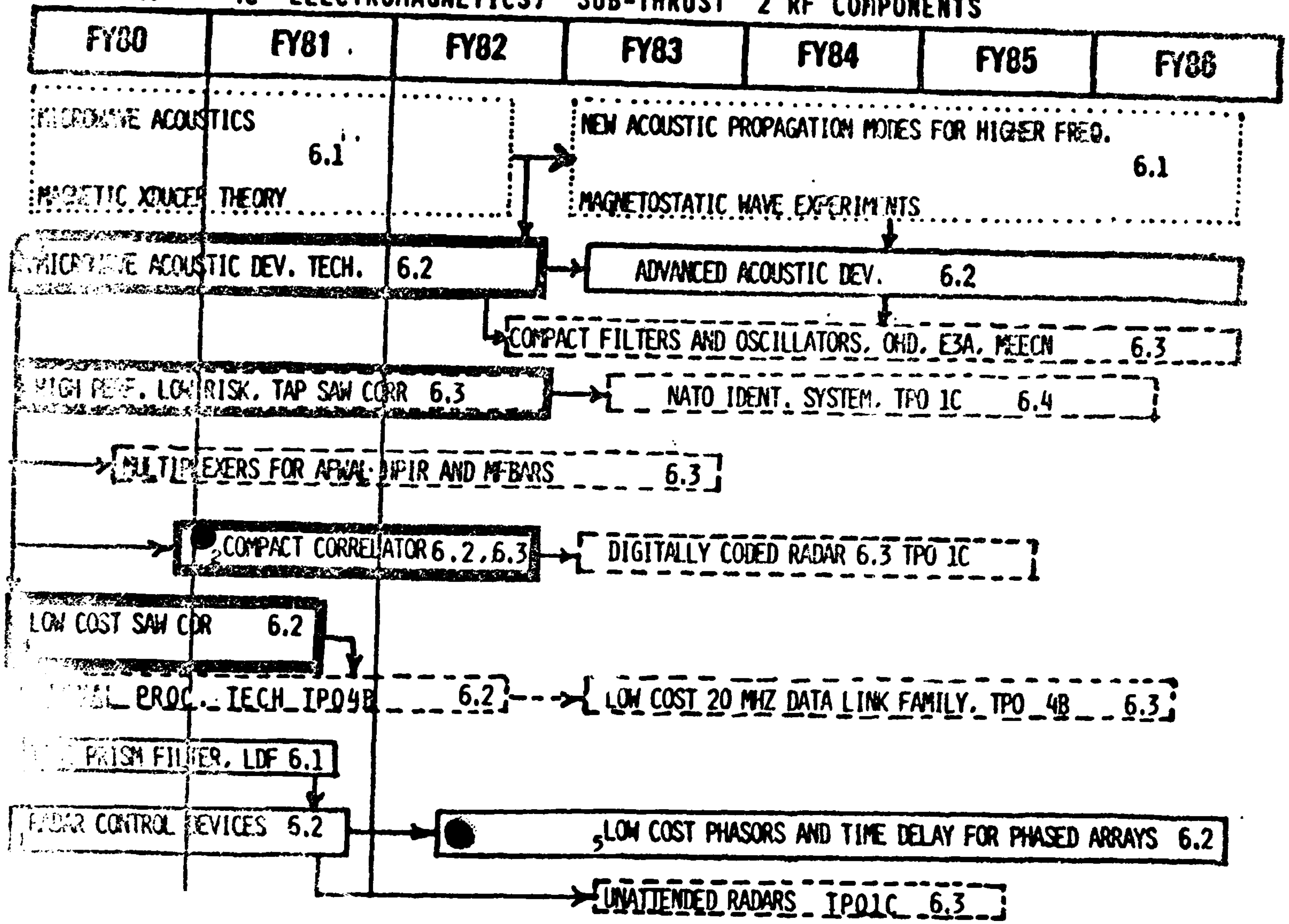
- SURFACE ACOUSTIC WAVES (SAW)
- MAGNETOSTATIC WAVES (MSW)
- RF SWITCHES AND PHASE SHIFTERS

PROGRAMS:

61102F	RESEARCH IN MICROWAVE ACOUSTICS AND MAGNETICS
62702F	EXPLORATORY DEVELOPMENT - RF COMPONENTS
63789F	COMPACT CORRELATORS - WIDE BAND RADARS
63742F	SAW CORRELATORS - NIS
63718F	MULTIPLEXERS FOR HPIR

RADC TPO 4 - TECHNOLOGY

THRUST: 4C ELECTROMAGNETICS, SUB-THRUST 2 RF COMPONENTS



TPO/THRUST: RADC TECHNOLOGY 4C ELECTROMAGNETICS

SUB/THRUST: RF COMPONENTS/4C20

EFFORT BLOCK TITLE: (1) MICROWAVE ACOUSTIC DEVICE TECHNOLOGY

TECHNICAL APPROACH: REDUCE AGING OF SAW OSCILLATORS, IMPROVE TIME-SPURIOUS PERFORMANCE OF SAW MULTIPLEXERS, DEVELOP LOW INTERMODULATION PRODUCT HF/VHF FILTERS, DEVELOP HIGH-Q MULTITONE FREQUENCY SYNTHESIZERS USING NEW BULK OVERTONE RESONATORS, DEVELOP BULK ACOUSTIC RESONATORS WITH HIGHER COUPLING AND Q THAN QUARTZ FOR MEDIUM-FREQUENCY FILTERS, AND DEVELOP HIGH FREQUENCY SAW CONVOLVERS.

PAYOFF: THE DEVELOPMENT OF NEW BULK AND SAW TECHNOLOGY WILL HAVE A HIGH PAYOFF FOR A LARGE NUMBER OF C^3I SYSTEMS (OHD AND DCR RADAR, MEECN, NIS, JTIDS, AND E3A). SAW COMPONENTS ARE SMALL, LIGHTWEIGHT, LOW-COST RADIATION-HARDENED, AND PROVIDE NEW OPERATIONAL CAPABILITIES.

TPO/THRUST: RADC TECHNOLOGY/4C/ELECTROMAGNETICS

SUB/THRUST: RF COMPONENTS/4C20

EFFORT BLOCK TITLE: COMPACT CORRELATOR (2)

OBJECTIVES: REDUCE SIZE, WEIGHT, AND COST OF WIDE-BAND TACTICAL RADAR CORRELATORS

TECHNICAL APPROACHES: ACHIEVE A PROCESSING GAIN OF 47 DB BY ADVANCING SAW CORRELATOR TECHNOLOGY AND/OR NOVEL APPROACHES FOR COMBINING SAW AND CCD/DIGITAL CORRELATORS

PAY OFF: NEW TECHNOLOGY WILL OVERCOME THE PRESENT SIZE-WEIGHT LIMITATIONS OF TACTICAL SPREAD-SPECTRUM RADAR PROCESSORS

TPO/THRUST: RADC TECHNOLOGY/4C/ELECTROMAGNETICS

SUB/THRUST: RF COMPONENTS/4C20

EFFORT BLOCK TITLE: (5) LOW COST PHASORS AND TIME DELAY UNITS

OBJECTIVE: DEVELOP LOW-COST, 6-BIT PHASE SHIFTERS. DEVELOP ELECTRONICALLY VARIABLE, WIDEBAND ELECTRONICALLY VARIABLE TIME DELAY UNITS

TECHNICAL APPROACH: NEW TECHNOLOGICAL APPROACHES FOR LOW-COST, 6-BIT PHASE SHIFTERS WILL BE EXPERIMENTALLY INVESTIGATED. MAGNETO-STATIC WAVE TECHNOLOGY WILL BE ADVANCED TO DEMONSTRATE ELECTRONICALLY VARIABLE TIME DELAY UNITS FOR TACTICAL PHASED ARRAYS

PAY OFF: ELECTRONICALLY VARIABLE TIME DELAY UNITS ARE ESSENTIAL TO MAINTAIN POINTING ACCURACY FOR PHASED ARRAYS, WHICH USE WIDE-BAND SPREAD SPECTRUM WAVEFORMS FOR ANTI-JAM. COMPACT MAGNETOSTATIC WAVE UNITS PROMISE TO REPLACE BULKY SWITCHED COAXIAL LINES.

THRUST: 4C ELECTROMAGNETICS

SUB/THRUST: 4C30 ELECTROMAGNETICS OF TARGETS AND ENVIRONMENT

PROGRAM GOALS: DEVELOPMENT OF TARGET, CLUTTER AND MULTIPATH MODELS USEFUL IN THE DESIGN AND EVALUATION OF ADVANCED COMMUNICATIONS AND SURVEILLANCE SYSTEMS

TECHNICAL AREAS:

- MEASUREMENTS
- FUNDAMENTAL STUDIES
- PHENOMENOLOGICAL CHARACTERIZATION
- TARGET SCATTERING AND MODELING
- TERRAIN AND FOLIAGE SCATTERING
- TARGET/MULTIPATH COHERENCE MODELING
- CLUTTER SENSITIVITY AND REAL TIME PREDICTION
- BISTATIC/SPREAD SPECTRUM CLUTTER/MULTIPATH MODELING
- APPLICATIONS

PROGRAMS:

61102F	BASIC RESEARCH IN ELECTROMAGNETIC SCATTERING
62702F	EXPLORATORY DEVELOPMENT
PEACE HAWK	PROPAGATION STUDIES

THRUST: 4C - ELECTROMAGNETICS

SUB-THRUST: 4C30 ELECTROMAGNETICS OF TARGETS AND ENVIRONMENT

SIGNIFICANT PROGRAM CHANGES

- SUB-THRUST FOCUS ON CLUTTER/MULTIPATH AND TARGET CHARACTERIZATION, MEASUREMENTS, AND MODELING
- INCREASED STRESS ON GROUND REFLECTIVITY MODELING
- FUTURE PROGRAMS IN CLUTTER MEASUREMENTS AND TARGET/ MULTIPATH COHERENCE

THRUST: 4C - ELECTROMAGNETICS

SUB-THRUST: 4C30 ELECTROMAGNETICS OF TARGETS AND ENVIRONMENT

CLUTTER/MULTIPATH MODELING DEFICIENCIES

- DATA AND MODEL REQUIREMENTS
  - LOW DEPRESSION ANGLE
  - BISTATIC
  - SPREAD SPECTRUM
  - AIRBORNE CLUTTER
  - TERRAIN AND FOLIAGE SCREENING
- MODELING TECHNOLOGY
  - THEORETICAL - EXPERIMENTAL CORRELATION
  - HETEROGENEOUS CLUTTER MODELING
  - TARGET - CLUTTER COUPLING
- MEASUREMENT TECHNIQUES
  - STANDARDIZATION AND CALIBRATION
  - COST

THRUST: 4C - ELECTROMAGNETICS

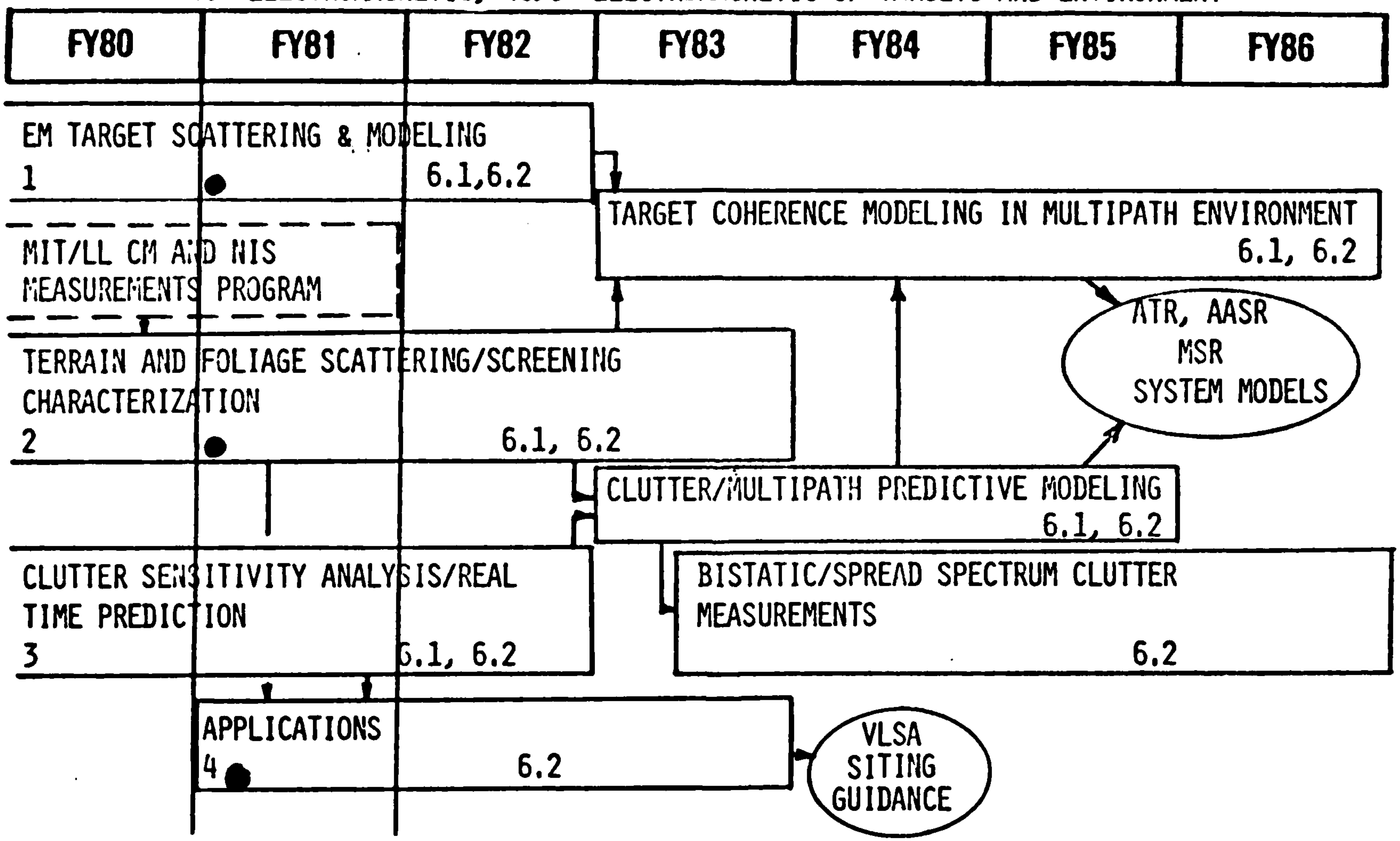
SUB-THRUST: 4C30 ELECTROMAGNETICS OF TARGETS AND ENVIRONMENT

PROGRAM FEATURES

- ADVANCED EM SCATTERING THEORIES
- NEW STATISTICAL CHARACTERIZATION OF TERRAIN PROPERTIES
- MEASUREMENTS AND COMPARISON WITH THEORY
- SENSITIVITY ANALYSIS FOR PHENOMENOLOGICAL MODELS
- ADVANCED STOCHASTIC MODELING OF COHERENCE PROPERTIES

RADC TPO 4 - TECHNOLOGY

THRUST: 4C ELECTROMAGNETIC; 4C30 ELECTROMAGNETIC OF TARGETS AND ENVIRONMENT



THRUST: 4C ELECTROMAGNETICS

SUB/THRUST: 4C30 ELECTROMAGNETICS OF TARGETS AND ENVIRONMENT

BLOCK TITLE: EM TARGET SCATTERING AND MODELING

OBJECTIVE:

- DEVELOP TECHNIQUES TO COMPUTE AND MEASURE THE ELECTROMAGNETIC SCATTERING FROM TARGETS
- DEVELOP PRACTICAL TARGET MODELS FOR RADAR SYSTEM ANALYSIS/SPECIFICATION

TECHNICAL APPROACH:

- ADVANCED COMPUTATIONAL AND MODELING PROCEDURES
- FIELD MEASUREMENT TECHNIQUES
- TARGET - CLUTTER INTERACTION MODELS

PAY OFF: ADVANCED TARGET MODELS FOR SPREAD SPECTRUM/BISTATIC DETECTION SYSTEM ANALYSIS AND SPECIFICATION

THRUST: 4C ELECTROMAGNETICS

SUB/THRUST: 4C30 ELECTROMAGNETICS OF TARGETS AND ENVIRONMENT

BLOCK TITLE: TERRAIN AND FOLIAGE SCATTERING/SCREENING CHARACTERIZATION

OBJECTIVE:

- DEVELOP AND CONFIRM IMPROVED TERRAIN SCATTERING MODELS FOR CLUTTER/MULTIPATH PREDICTION
- DEVELOP TECHNIQUES FOR OBTAINING SENSITIVE MODEL PARAMETERS FROM TOPOGRAPHIC MAPS AND OTHER SOURCES

TECHNICAL APPROACH:

- ROUGH SURFACE SCATTERING THEORIES
- SURFACE FEATURE EXTRACTION TECHNIQUES

PAY OFF: IMPROVED GROUND CLUTTER/MULTIPATH CHARACTERIZATION AND MORE EFFECTIVE USE OF MODERN RADAR SYSTEM CLUTTER SUPPRESSION AND DETECTION TECHNOLOGY

THRUST: 4C ELECTROMAGNETICS

SUB/THRUST: 4C30 ELECTROMAGNETICS OF TARGETS AND ENVIRONMENT

BLOCK TITLE: APPLICATIONS

OBJECTIVE: EVALUATE ENVIRONMENTAL CONSTRAINTS ON PERFORMANCE OF VERY LOW SIDE ANTENNAS AND INTERFERENCE BETWEEN SPREAD SPECTRUM SYSTEMS

TECHNICAL APPROACH:

- DETERMINE DEGRADED SIDELOBE LEVEL DUE TO SPECULAR AND DIFFUSE GROUND REFLECTIVITY; DEVELOP SITING CRITERIA
- EVALUATE INTERFERENCE MODELS FOR GROUND SITED SPREAD SPECTRUM RADARS; DEVELOP INTERFERENCE REDUCTION CRITERIA

PAY OFF: SITING CRITERION AND IMPROVED FIELD PERFORMANCE

<u>THRUST:</u> 4C ELECTROMAGNETICS

<u>SUB/THRUST:</u> 4 PROPAGATION

<u>PROGRAM GOALS:</u> DEVELOP NEW RADIO WAVE PROPAGATION TECHNIQUES TO IMPROVE COMMUNICATION, NAVIGATION AND DETECTION CAPABILITIES WITHIN THE AIR FORCE

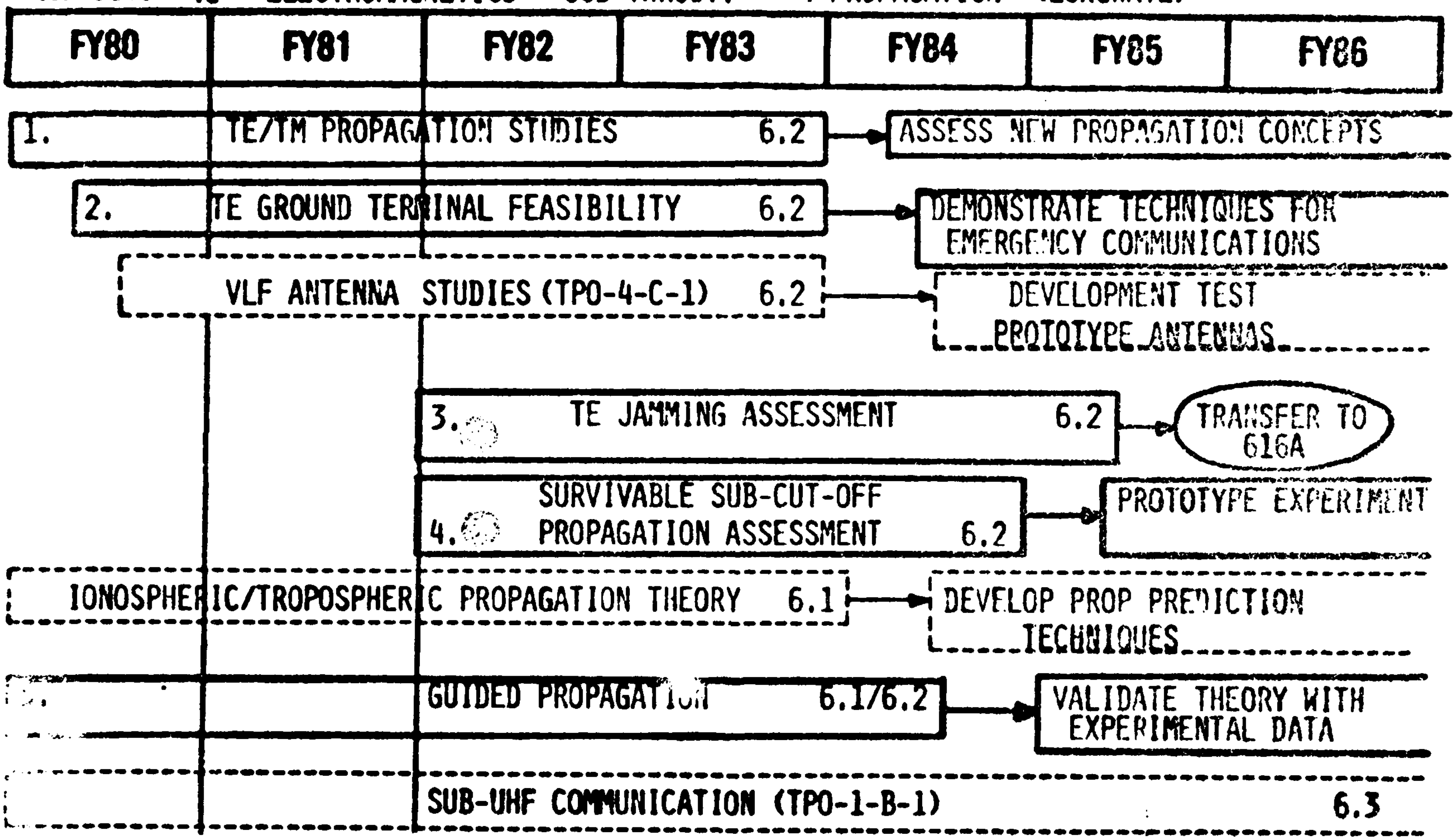
<u>TECHNICAL AREAS:</u> LONG-WAVE, MICROWAVE, HIGH-FREQUENCY PROPAGATION

<u>PROGRAMS:</u>

61102F	BASIC RESEARCH IN WAVE PROPAGATION THEORY, MICROWAVE PROPAGATION AND AURORAL CLUTTER
62702F	EXPLORATORY DEVELOPMENT IN EM PROPAGATION
63703F	CONUS OTH PROPAGATION SIMULATION
33131F	MEECN MEASUREMENTS AND CALCULATIONS

RADC TPO 4 TECHNOLOGY

THRUST: 4C ELECTROMAGNETICS SUB-THRUST: 4 PROPAGATION (LONGWAVE)



THRUST: 4C ELECTROMAGNETICS

SUB/THRUST: 4 PROPAGATION

BLOCK TITLE: TE JAMMING ASSESSMENT

OBJECTIVE: ASSESS INHERENT JAMMING/ANTI-JAM FEATURES OF TRANSVERSE ELECTRIC (TE) AND TRANSVERSE MAGNETIC (TM) MODES OF PROPAGATION

TECHNICAL APPROACH: DEVELOP TE/EM JAMMING ASSESSMENT MODELS (THEORETICAL) AND CONDUCT EXPERIMENTS USING EEP POWERLINE TRANSMITTING FACILITY IN NORTHERN GREENLAND. COMPARE THEORY AND EXPERIMENTAL DATA

PAY OFF: POSSIBLE EXPLOITATION OF THE PROPAGATION MEDIUM FOR JAMMING/ANTI-JAM PURPOSES.

THRUST: 4C ELECTROMAGNETICS

SUB-THRUST: 4 PROPAGATION

BLOCK TITLE: SURVIVABLE SUB CUT-OFF PROPAGATION ASSESSMENT

OBJECTIVE: DETERMINE FEASIBILITY/DESIRABILITY OF COMMUNICATIONS USING LONG RADIO WAVES WITH FREQUENCIES BELOW THE CUTOFF OF THE EARTH-IONOSPHERE WAVEGUIDE.

TECHNICAL APPROACH: DEVELOP PROPAGATION PREDICTION THEORY AND COMPUTER CODES FOR ASSESSING THE FEASIBILITY OF BELOW CUTOFF PROPAGATION, AND FOR DETERMINING ENGINEERING PARAMETERS FOR A DEMONSTRATION EXPERIMENT.

PAY-OFF: POSSIBLE NEW TECHNIQUE FOR SURVIVABLE, JAM-RESISTANT COMMUNICATIONS.

THRUST: 4C ELECTROMAGNETICS

SUB-THRUST: 4 PROPAGATION

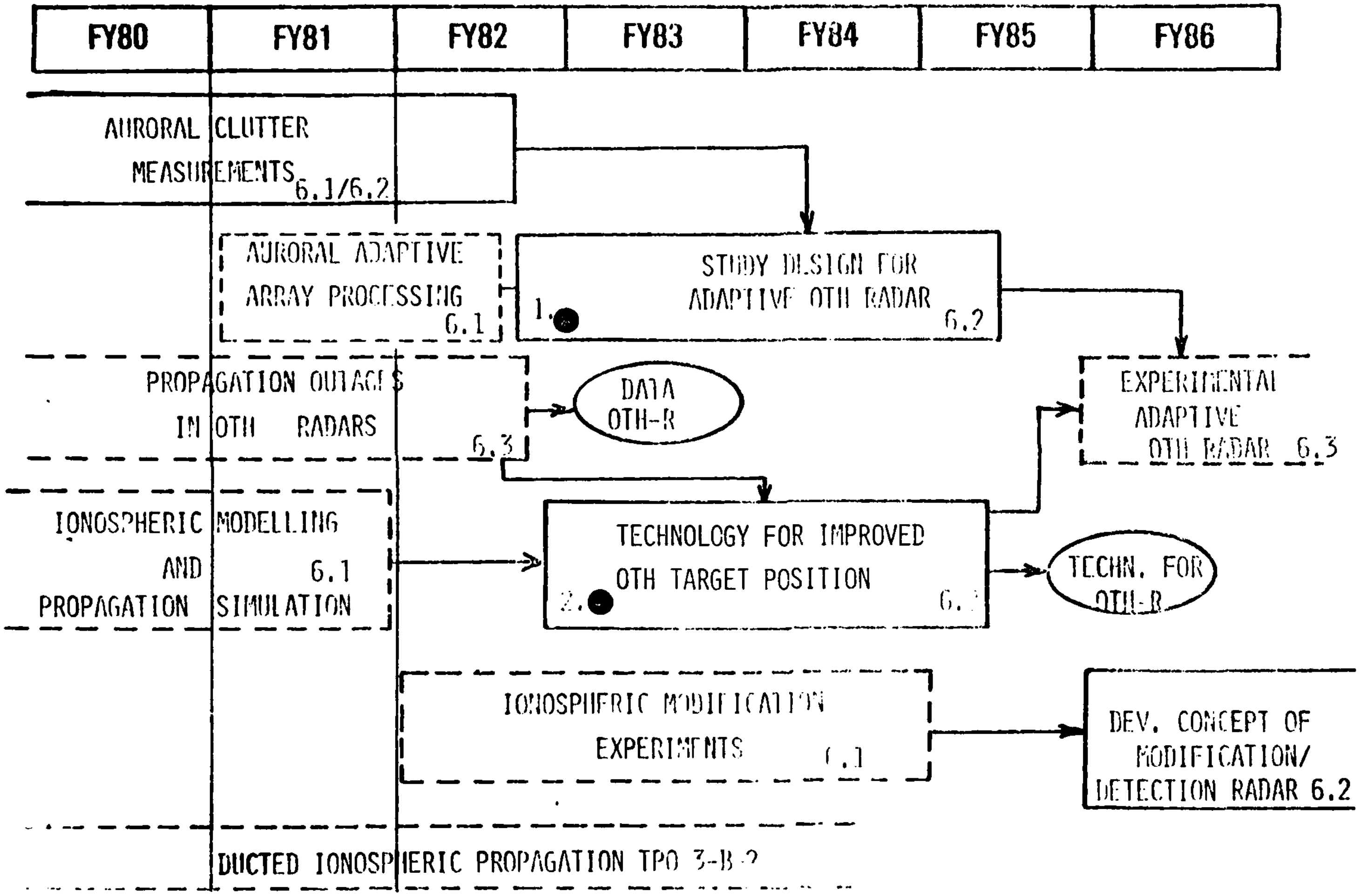
BLOCK TITLE: GUIDED PROPAGATION

OBJECTIVE: DEVELOP MATHEMATICAL THEORY FOR SURFACE WAVE, TROPOSPHERIC DUCT AND WHISPERING GALLERY MODE

TECHNICAL APPROACH: COMBINE RAY WITH MODE SOLUTIONS AND TEST EXPERIMENTALLY

PAY-OFF: IMPROVE RANGE AND SECURITY OF COMMUNICATION LINKS

RADC TPO 4 TECHNOLOGY
THRUST: 4C ELECTROMAGNETICS SUB-THRUST: 4 PROPAGATION (HIGH-FREQUENCY)



THRUST: 4C ELECTROMAGNETICS

SUB-THRUST: 4 PROPAGATION

BLOCK TITLE: STUDY DESIGN FOR ADAPTIVE OTH RADAR

OBJECTIVE: DEVELOP TECHNIQUE FOR ADAPTING OTH RADAR OPERATION TO COMPENSATE FOR AURORAL CLUTTER.

TECHNICAL APPROACH: USE DATA COLLECTED BY HIGH RESOLUTION AURORAL BACKSCATTER SOUNDING TO FORMULATE REQUIREMENTS FOR RADAR ANTENNA RESOLUTION AND DATA PROCESSING

PAY-OFF: IMPROVED TARGET VISIBILITY AND DETECTION PERFORMANCE OF OTH RADARS

THRUST: 4C ELECTROMAGNETICS

SUB-THRUST: 4 PROPAGATION

BLOCK TITLE: TECHNOLOGY FOR IMPROVED OTH TARGET POSITION

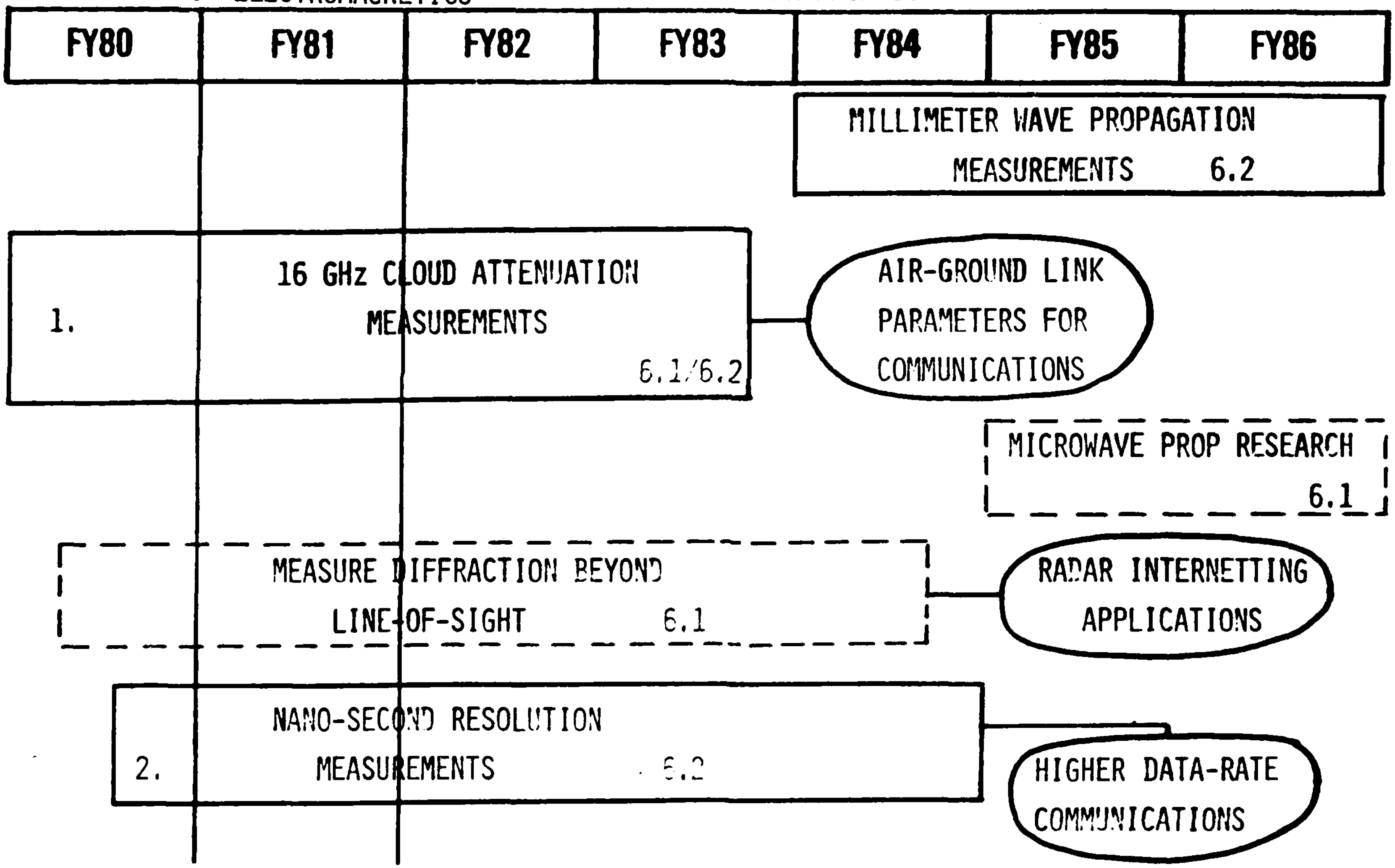
OBJECTIVE: DEVELOP REAL TIME TECHNIQUES FOR COMPENSATION OF IONOSPHERIC-INDUCED RADAR TARGET POSITION/MOVEMENT.

TECHNICAL APPROACH: DEVELOP SIMULATION PROCEDURES BASED ON IONOSPHERIC MODELS AND HIGH RESOLUTION SOUNDING OF THE AURORAL IONOSPHERE

PAY-OFF: ENHANCED ACCURACY OF OTH RADAR TARGET LOCATION IN THE AURORAL REGIONS AND ELSEWHERE

RADC TPO 4 TECHNOLOGY

THRUST: 4C ELECTROMAGNETICS SUB-THRUST: 4 PROPAGATION (MICROWAVE)



KEY PROGRAM MANAGERS

ANTENNAS	DR R. J. MAILLOUX	RADC/EEA	617-861-3710
RF COMPONENTS	DR PAUL CARR	RADC/EEA	617-861-3686
TARGETS & ENVIRONMENT	DR J. K. SCHINDLER	RADC/EEC	617-861-3723
HF PROPAGATION	DR T. J. ELKINS	RADC/EEP	617-861-2900
LONG WAVE PROPAGATION	JOHN RASMUSSEN	RADC/EEP	617-861-4239
MICROWAVE PROPAGATION	DR E. E. ALTSHULER	RADC/EEP	617-861-4662

SOLID STATE DEVICES

(INDUSTRY LOOKS AT RADC)

SPEAKER

BOBBY L. BUCHANAN
RADC/ESR, HANSCOM AFB
TEL. 617-861-4051

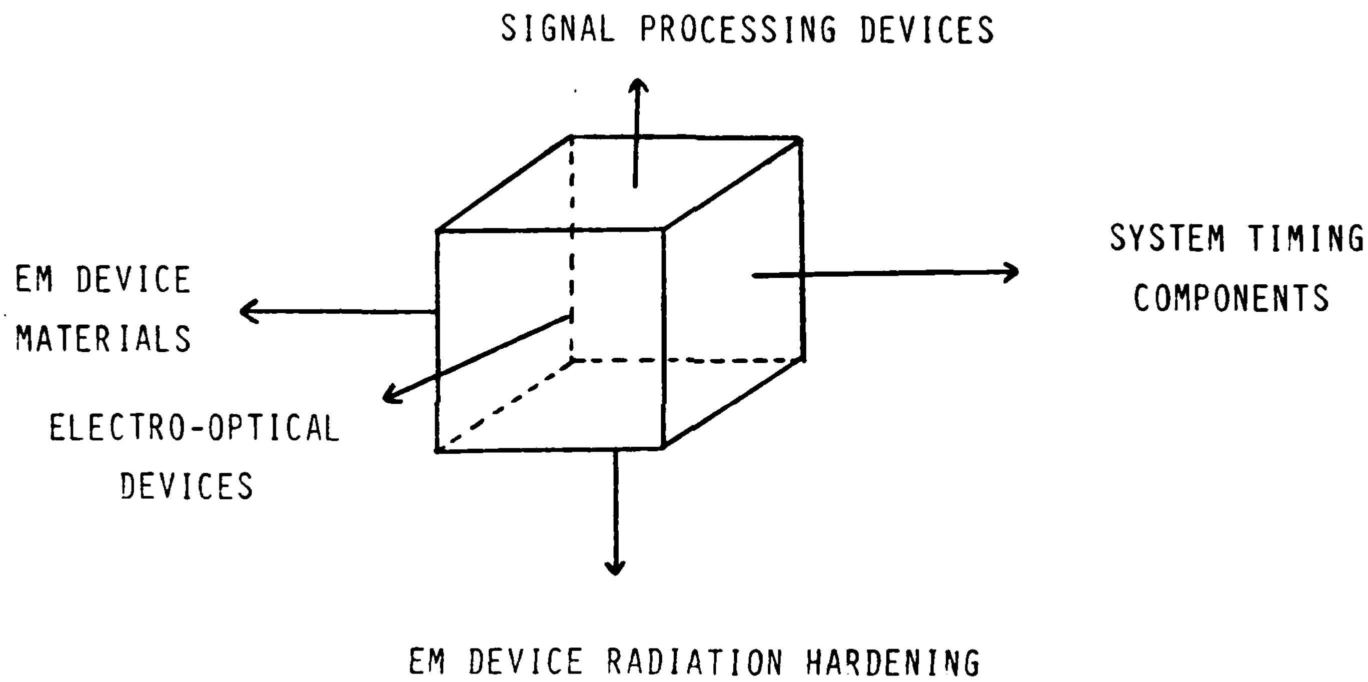
SOLID STATE DEVICES

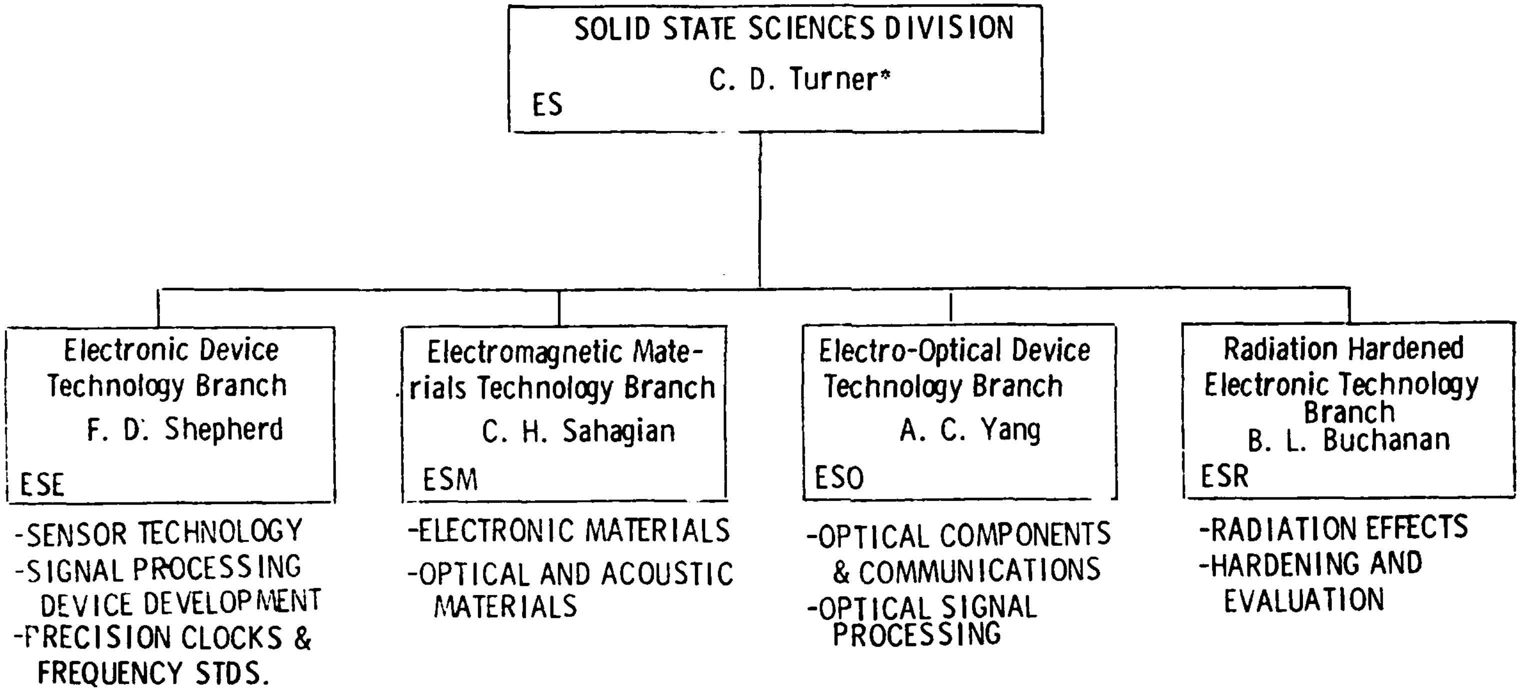
WHAT

WHY

WOW!

SOLID STATE DEVICES





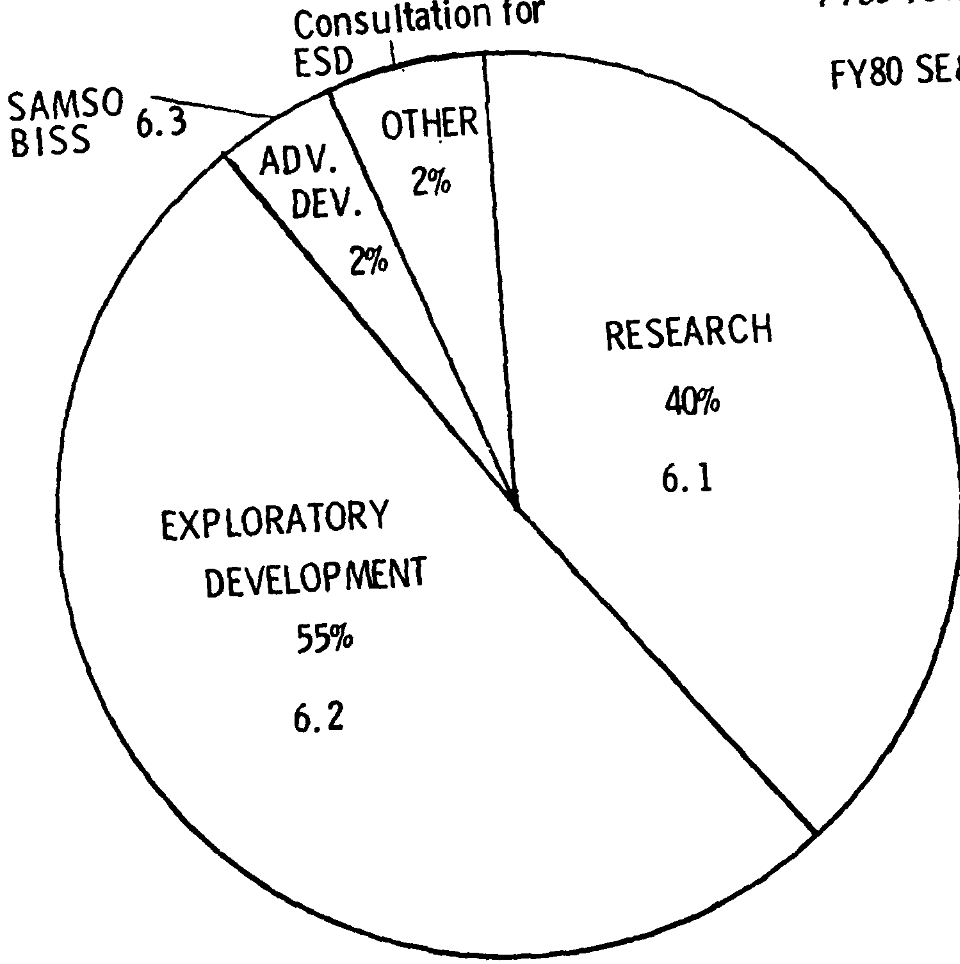
*Acting Director

SOLID STATE SCIENCES DIVISION

FY80 MANPOWER

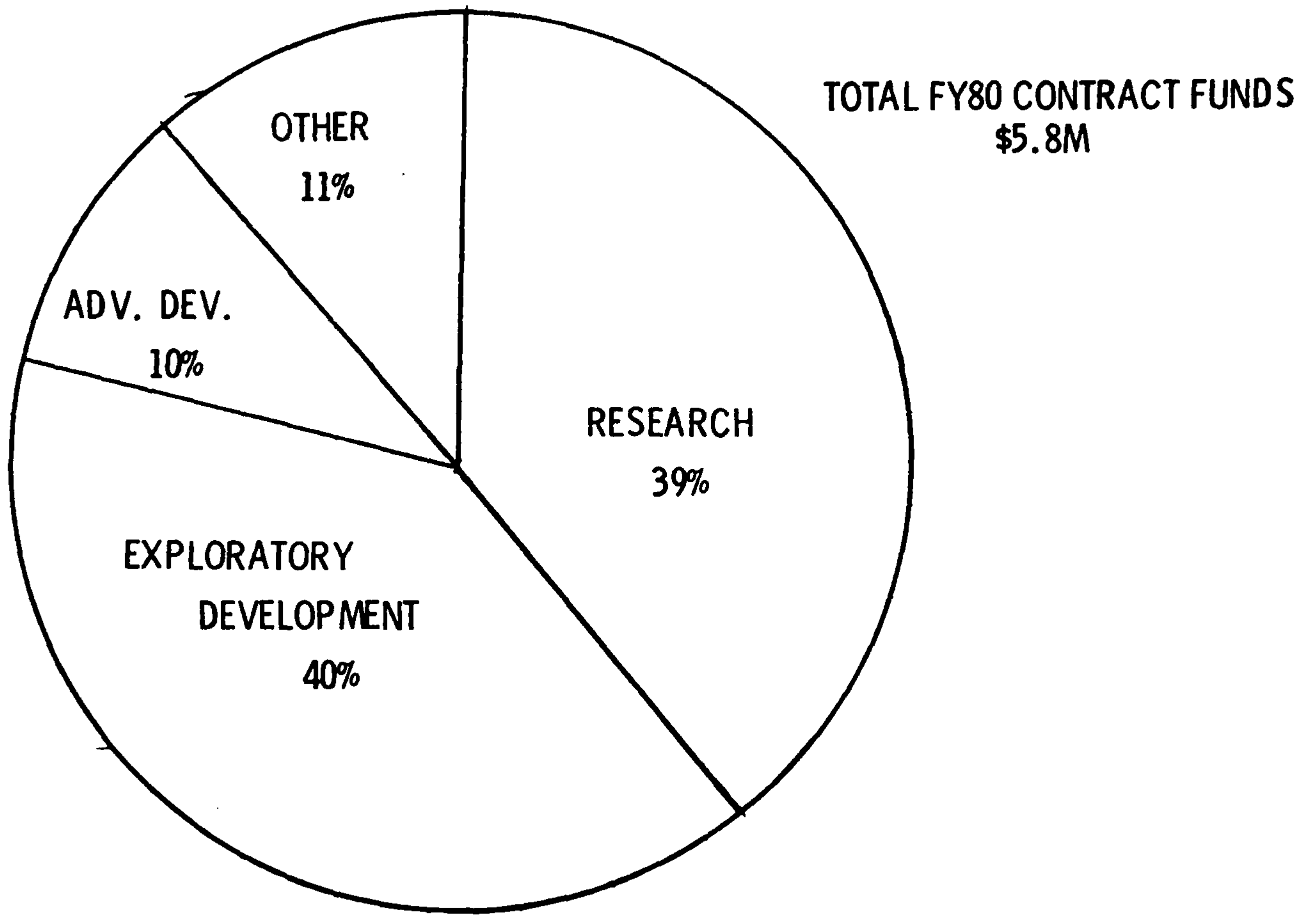
FY80 TOTAL MANPOWER - 92

FY80 SE&T MANPOWER - 78



SOLID STATE SCIENCES DIVISION

FY80 CONTRACT FUNDING



SOLID STATE DEVICES

SYSTEM TIMING COMPONENTS - DR. YANNONI

PROGRAM GOALS:

- DEVELOP PRECISE TIME AND TIME INTERVAL TECHNOLOGY REQUIRED BY AIR FORCE SYSTEMS
- ADVANCE THE STATE OF THE ART IN THE AREAS OF PERFORMANCE, RELIABILITY, AND ECONOMY

TECHNICAL AREAS:

- QUARTZ RESONATORS AND OSCILLATORS
- ATOMIC FREQUENCY STANDARDS AND CLOCKS
- TEST AND EVALUATION

TPO THRUST #/TITLE: 4D / SOLID STATE DEVICES

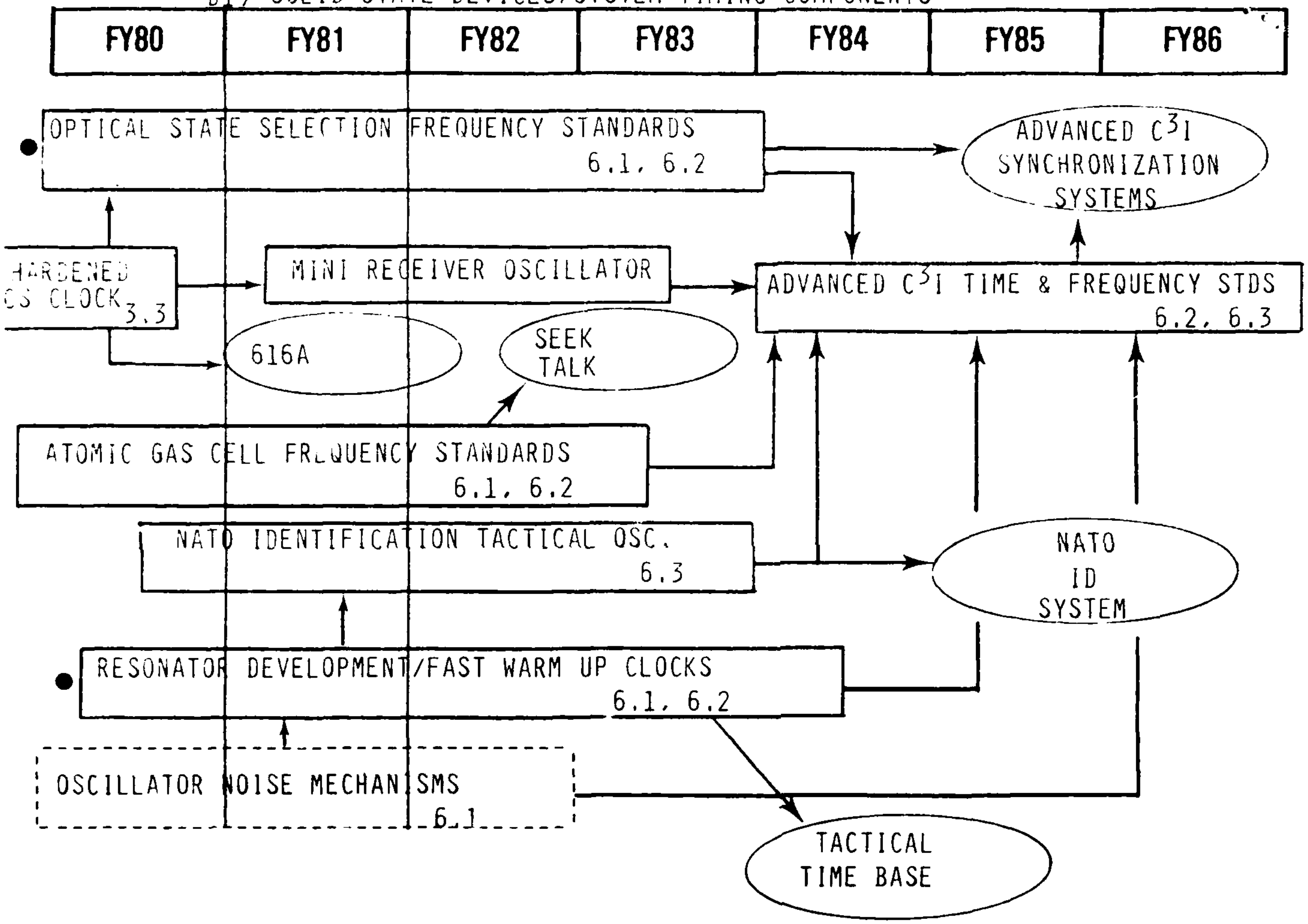
SUB-THRUST #/TITLE: 1 / SYSTEM TIMING COMPONENTS

MAJOR NON-DL PROGRAMS SUPPORTED

NON-DL PROGRAM	SUPPORT PROVIDED	CUSTOMER
616A/AF SUPPORT TO MEECN	DEVELOPMENT OF PORTABLE REAL-TIME CLOCK (CESIUM)	ESD
NIS/NATO IDENTIFICATION SYSTEM	TEST/EVALUATION OF CANDIDATE TIME BASE, QUARTZ OSCILLATOR DEVELOPMENT	ASD
SEEK TALK	DEVELOPMENT OF SMALL MILITAR-IZED RUBIDIUM STANDARD AND NEW DESIGN RUBIDIUM STANDARD	RADC/ESD
61102F	COMPONENT RESEARCH	AFOSR

RADC TPO 4 / TECHNOLOGY

THRUST: D1 / SOLID STATE DEVICES/SYSTEM TIMING COMPONENTS



SOLID STATE DEVICES

ELECTRO OPTICAL COMPONENTS - DR. YANG

<u>PROGRAM GOALS</u>:

- COMPONENTS AND TECHNIQUES FOR FIBER OPTIC COMMUNICATIONS
- INTRUSION ALARM CONCEPTS AND FIELD TEST INTRUSION RESISTANT FIBER OPTIC LINK
- PRACTICAL, REAL-TIME, OPTICAL SIGNAL PROCESSING

<u>TECHNICAL AREAS</u>:

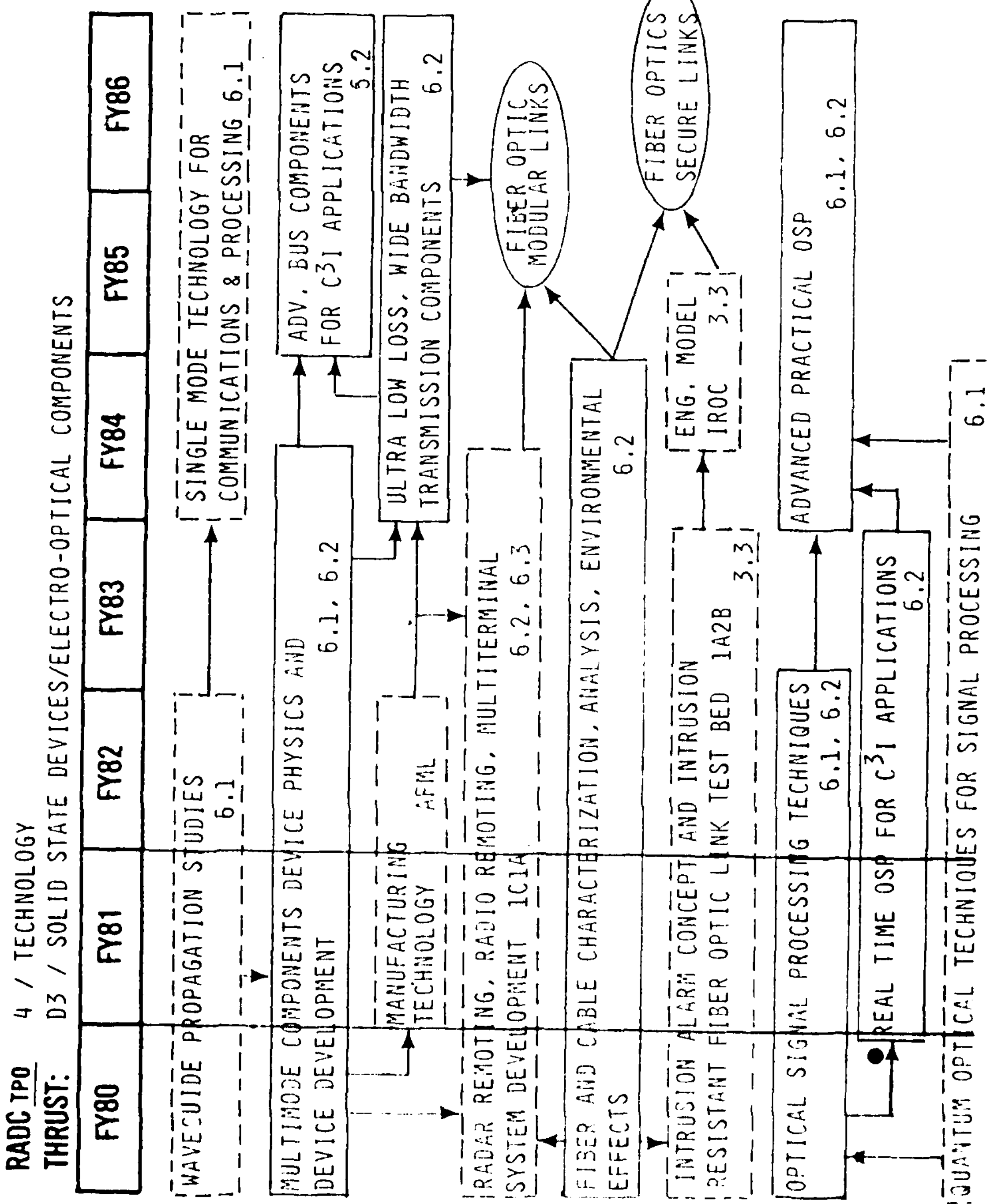
- OPTICAL COMMUNICATION AND COMPONENTS
- OPTICAL SIGNAL PROCESSING AND COMPONENTS

TPO THRUST #/TITLE: 4D / SOLID STATE DEVICES

SUB-THRUST #/TITLE: 3 / ELECTRO-OPTICAL COMPONENTS

MAJOR NON-DL PROGRAMS SUPPORTED

NON-DL PROGRAM NUMBER/SHORT TITLE	SUPPORT PROVIDED SHORT DESCRIPTIVE PHASES	CUSTOMER
PE33401G PE33401F/P7820	OPTICAL TIME DOMAIN REFLECTING MEASUREMENTS AND THEORY	NSA RADC/EEV
FIBER OPTICS INTRUSION ALARM CONCEPTS	EXHAUSTIVE CHARACTERIZATION AND ANALYSIS OF SYSTEMS SHOW FEASIBILITY ENVIRONMENTAL EFFECTS LINK STABILITY	
61102F	COMPONENT RESEARCH	AFOSR


RADC TPO 4 / TECHNOLOGY
THRUST: D3 / SOLID STATE DEVICES/ELECTRO-OPTICAL COMPONENTS
FY80
FY81
FY82
FY83
FY84
FY85
FY86
WAVEGUIDE PROPAGATION STUDIES 6.1
SINGLE MODE TECHNOLOGY FOR COMMUNICATIONS & PROCESSING 6.1
MULTIMODE COMPONENTS DEVICE PHYSICS AND DEVICE DEVELOPMENT 6.1, 6.2
ADV. BUS COMPONENTS FOR C3I APPLICATIONS 6.2
MANUFACTURING TECHNOLOGY AFML
ULTRA LOW LOSS, WIDE BANDWIDTH TRANSMISSION COMPONENTS 6.2
RADAR REMOTING, RADIO REMOTING, MULTITERMINAL SYSTEM DEVELOPMENT 1C1A 6.2, 6.3
FIBER OPTIC MODULAR LINKS
FIBER AND CABLE CHARACTERIZATION, ANALYSIS, ENVIRONMENTAL EFFECTS 6.2
FIBER OPTICS SECURE LINKS
INTRUSION ALARM CONCEPT AND INTRUSION RESISTANT FIBER OPTIC LINK TEST BED 1A2B 3.3
ENG. MODEL IROC 3.3
OPTICAL SIGNAL PROCESSING TECHNIQUES 6.1, 6.2
ADVANCED PRACTICAL OSP 6.1, 6.2
REAL TIME OSP FOR C3I APPLICATIONS 6.2
QUANTUM OPTICAL TECHNIQUES FOR SIGNAL PROCESSING 6.1

SOLID STATE SCIENCES

SIGNAL PROCESSING DEVICES - DR. SHEPHERD

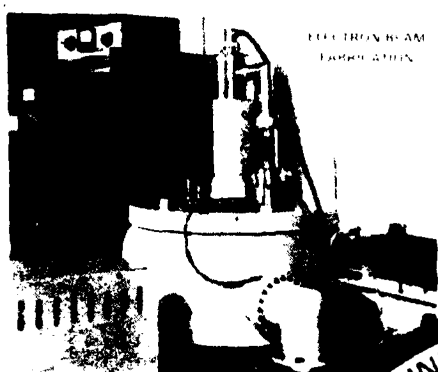
<u>PROGRAM GOALS</u>:

- o DEVELOP ADVANCED SIGNAL PROCESSING DEVICES

<u>TECHNICAL AREAS</u>:

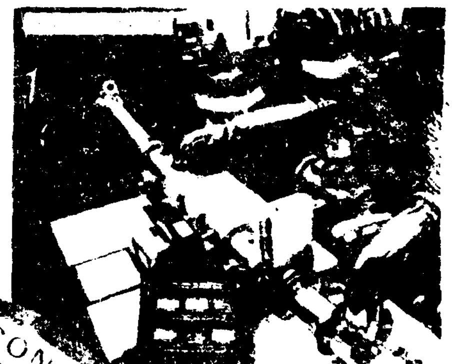
- o DEVICE DESIGN-DEVELOPMENT AND DEMONSTRATION
- o VHSIC
- o ADVANCED LITHOGRAPHY

DEVICE FABRICATION TECHNOLOGY

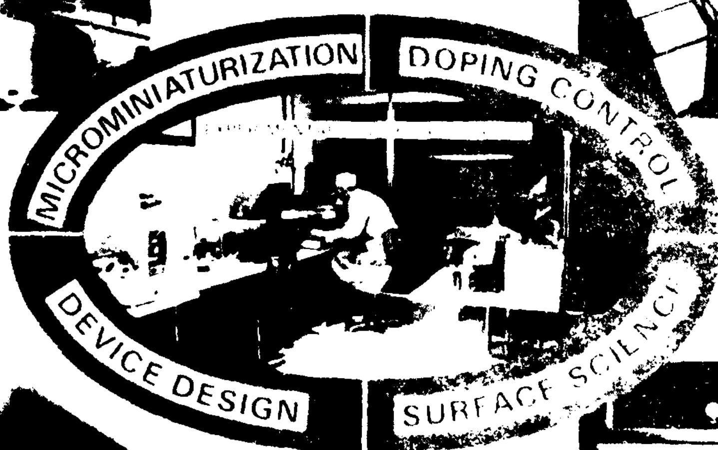


ELECTRON BEAM FABRICATION

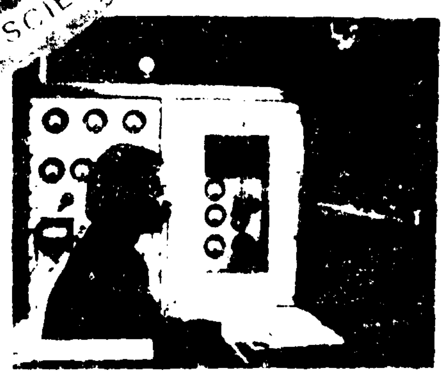
R&D



IN



RESULTS IN



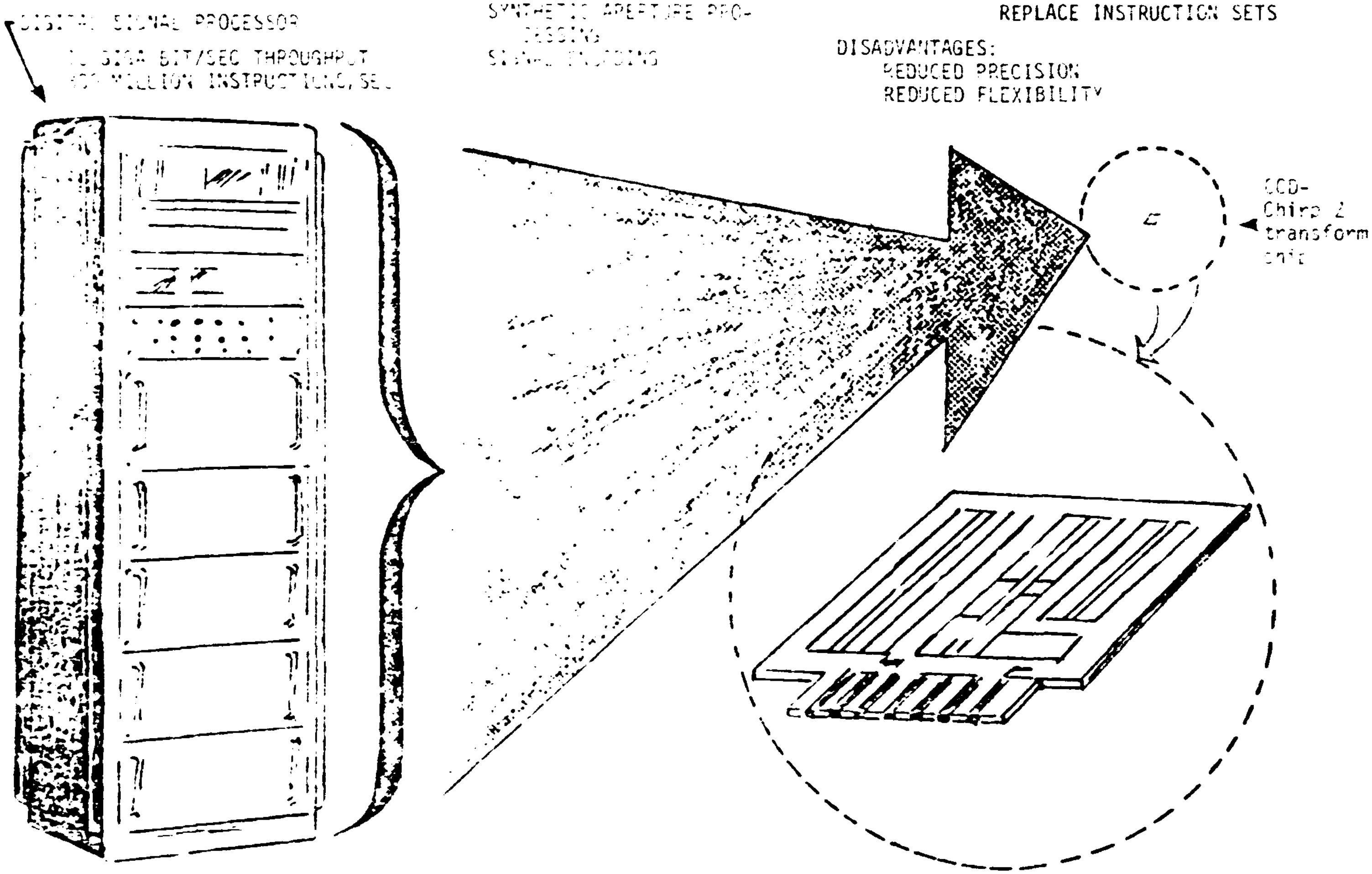
MILITARY ELECTRONICS

SIGNAL PROCESSING DEVICES – ANALOG CCD's

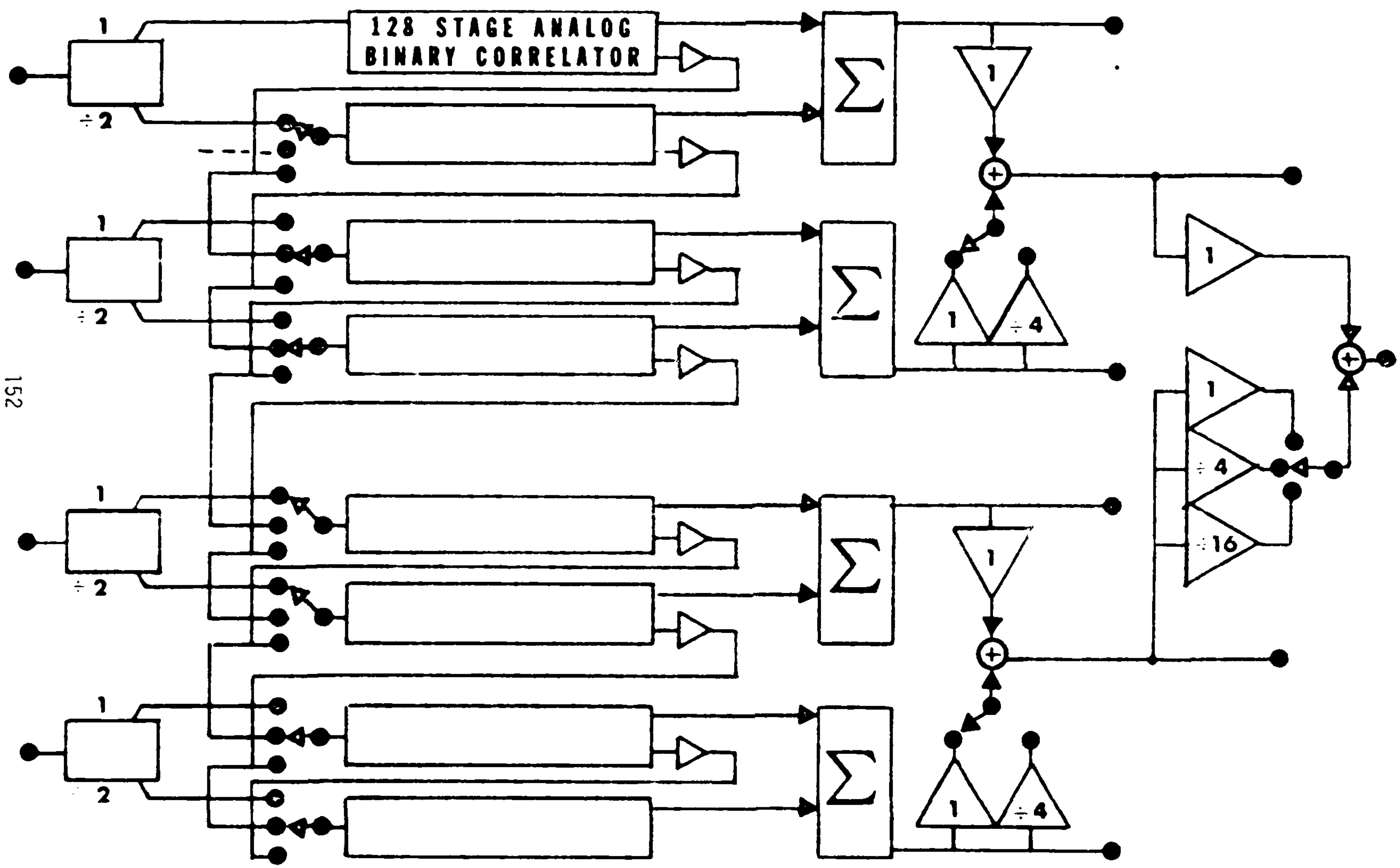
APPLICATIONS:
SPREAD SPECTRUM COMMUNICATIONS
[illegible] PROCESSING
SYNTHETIC APERTURE PROCESSING
SIGNAL [illegible]

ADVANTAGES:
REDUCE SUBSYSTEM COMPLEXITY & COST
NUMBER OF COMPONENTS
NECESSARY OPERATING SPEED
FULL FUNCTION OPERATIONS
REPLACE INSTRUCTION SETS

DISADVANTAGES:
REDUCED PRECISION
REDUCED FLEXIBILITY



CCD-SCALAR PRODUCT OPERATOR



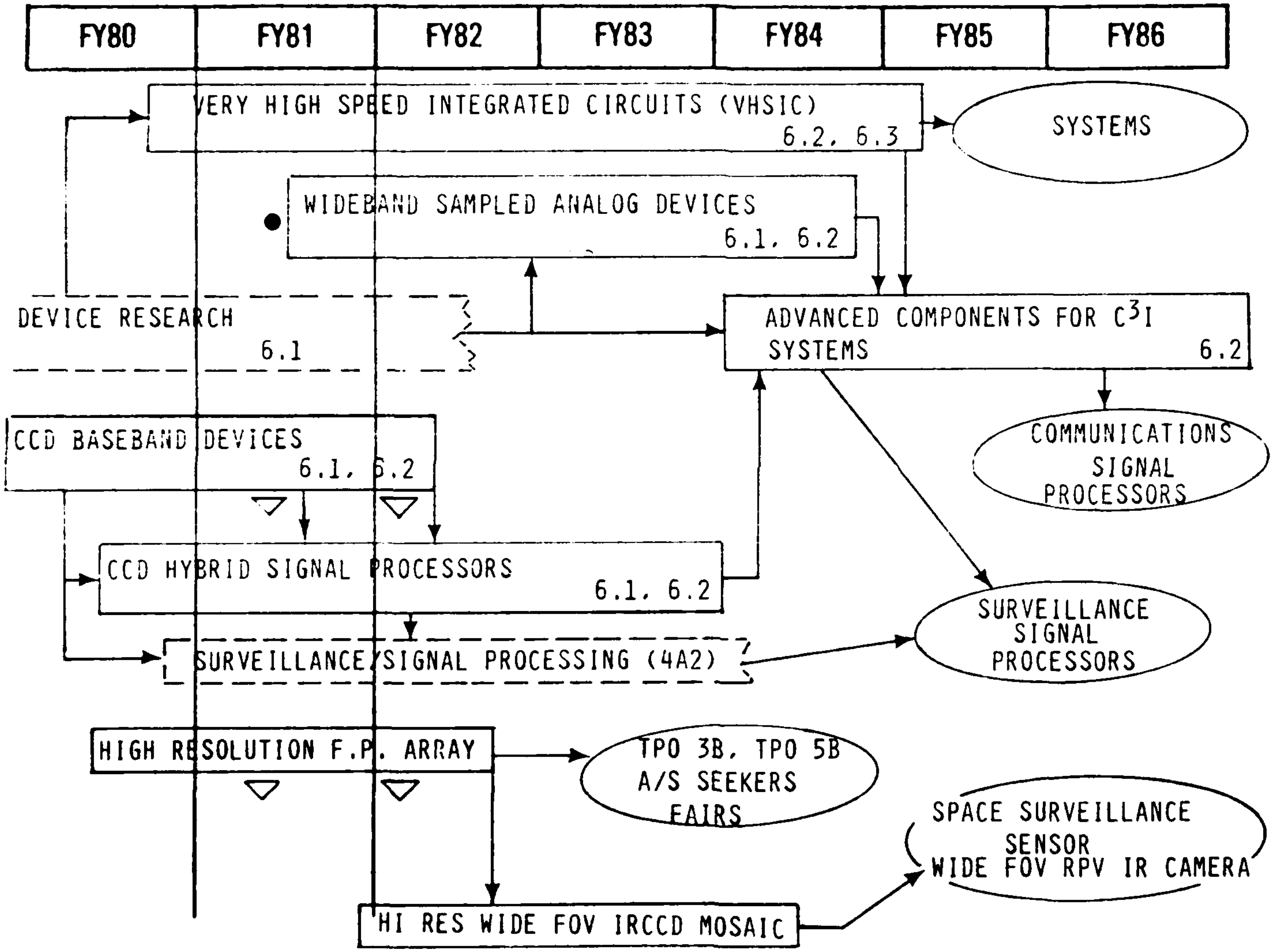
TPO THRUST #/TITLE: 4D / SOLID STATE DEVICES

SUB-THRUST #/TITLE: 2 / SIGNAL PROCESSING DEVICES

MAJOR NON-DL PROGRAMS SUPPORTED

NON-DL PROGRAM	SUPPORT PROVIDED	CUSTOMER
VHSIC	PROGRAM MANAGEMENT TECHNICAL EVALUATION	
ADVANCED DEVICE PROCESSING	TECHNICAL MANAGEMENT	DARPA
MINI HALO	SIGNAL PROC. DEV.	RADC/OC - DARPA
AOSP	SIGNAL PROC. DEV.	RADC/OC - DARPA
TEAL AMBER	FOCAL PLANE MOSAIC CONSULTATION	RADC/OC - DARPA
SCHOTTKY FPA	FOCAL PLANE MOSAIC DEVELOPMENT	ESD - ARMY - DNA
61102F	DEVICE RESEARCH	AFOSR

RADC TPO 4 / TECHNOLOGY
THRUST: D2 / SOLID STATE DEVICES/SIGNAL PROCESSING DEVICES

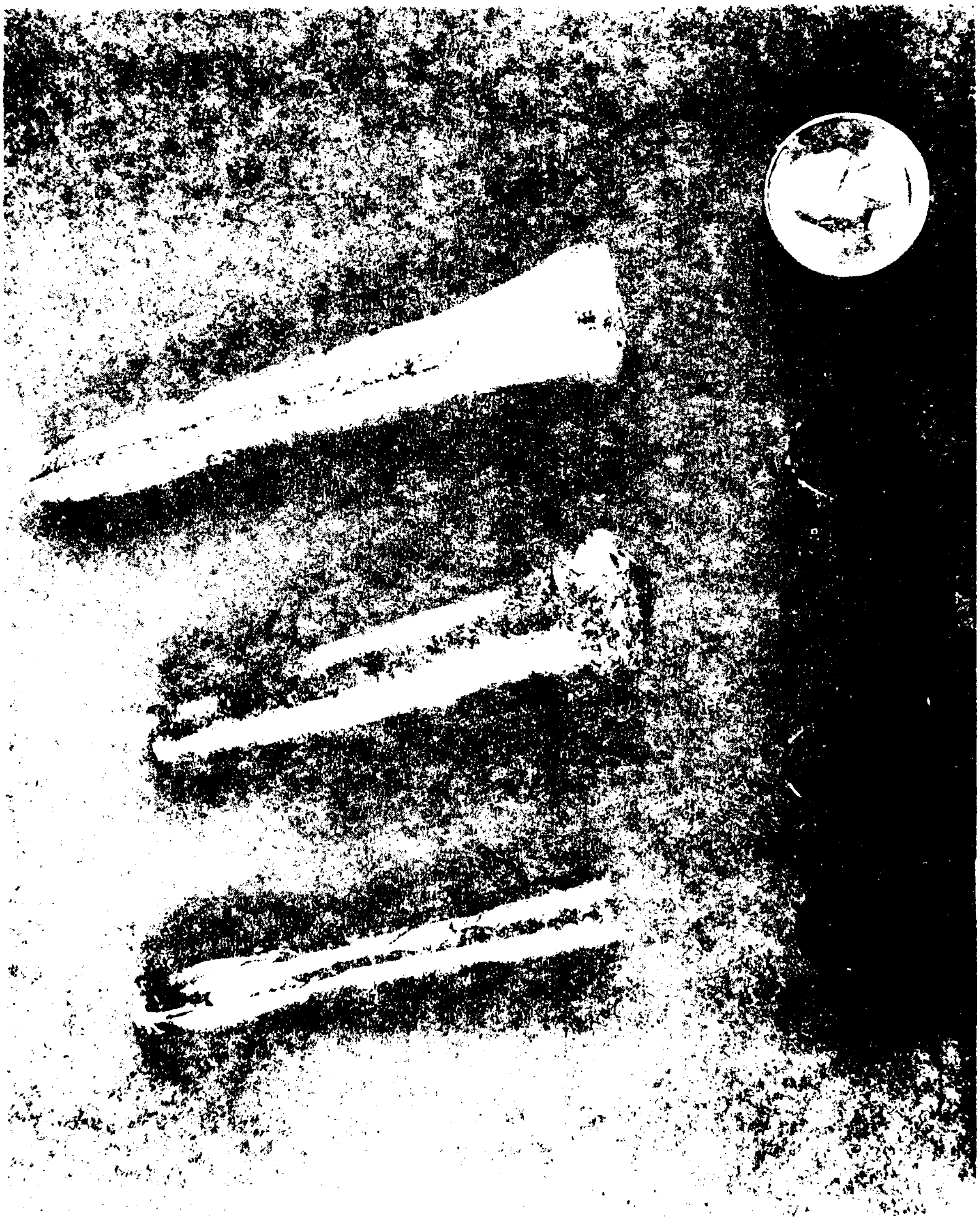


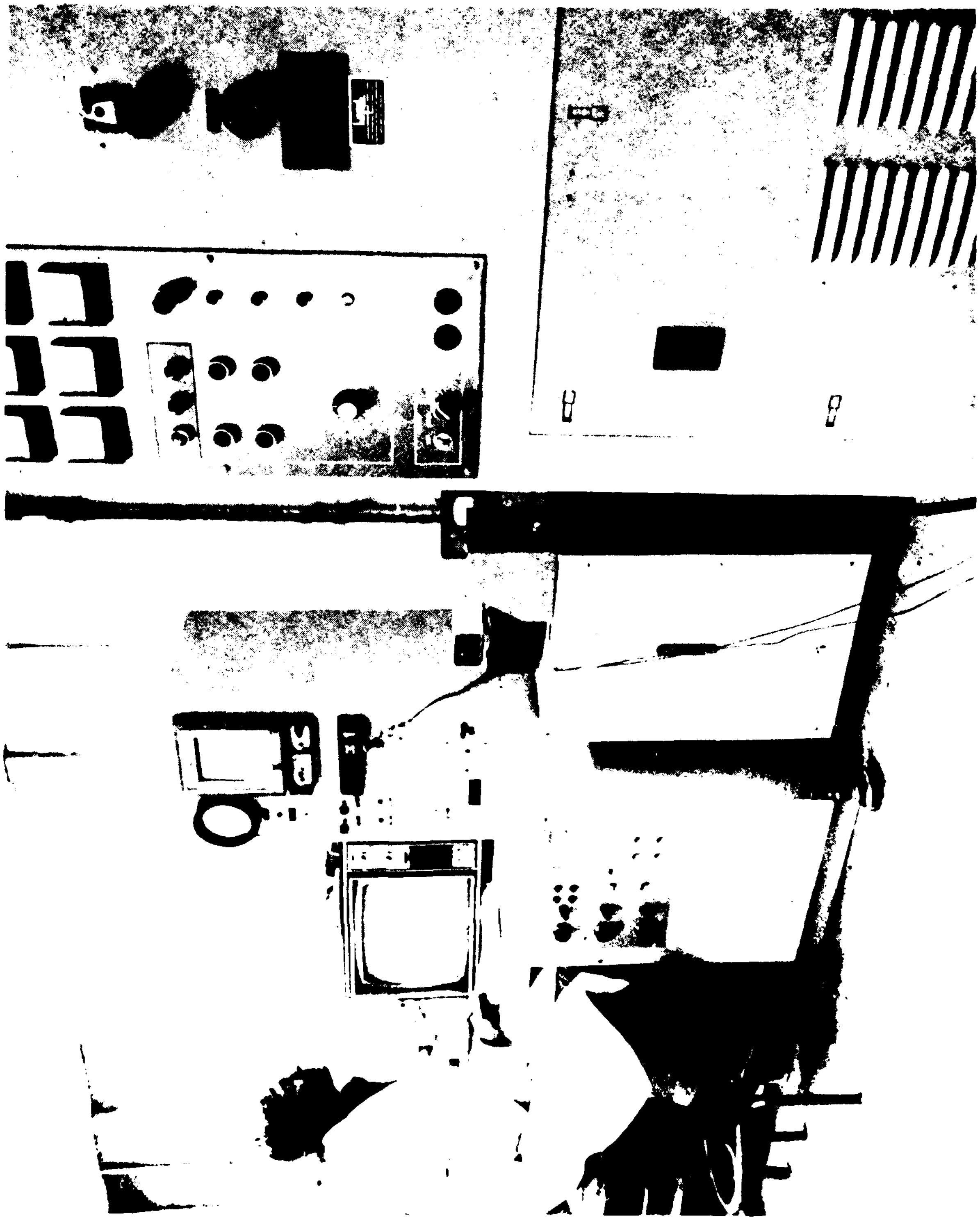
SOLID STATE DEVICES

EM DEVICE MATERIALS - MR. SAHAGIAN

<u>PROGRAM GOALS</u>: TO IMPROVE C^3 SYSTEM PERFORMANCE AND COST FACTORS VIA THE RESEARCH AND DEVELOPMENT OF ADVANCED ELECTROMAGNETIC MATERIALS.

<u>TECHNICAL AREAS</u>: SEMICONDUCTOR, OPTICAL, ACOUSTIC MATERIALS





SOLID STATE DEVICES

EM DEVICE MATERIALS

<u>LONG TERM EMPHASIS</u>

- FIBER OPTIC MATERIAL - FLOURIDE GLASSES

  LONG WAVELENGTH (1 TO 10μ) FOR LOW ATTENUATION FOR LONG LINE COMMUNICATION

- INDIUM PHOSPHIDE MATERIAL

  InP FOR SUBSTRATE WITH GOOD LATTICE WATCH FOR InGaAsP

- ULTRA QUALITY QUARTZ

  FOR HIGH PRECISION RADIATION TOLERANT ETC. TIMING APPLICATIONS

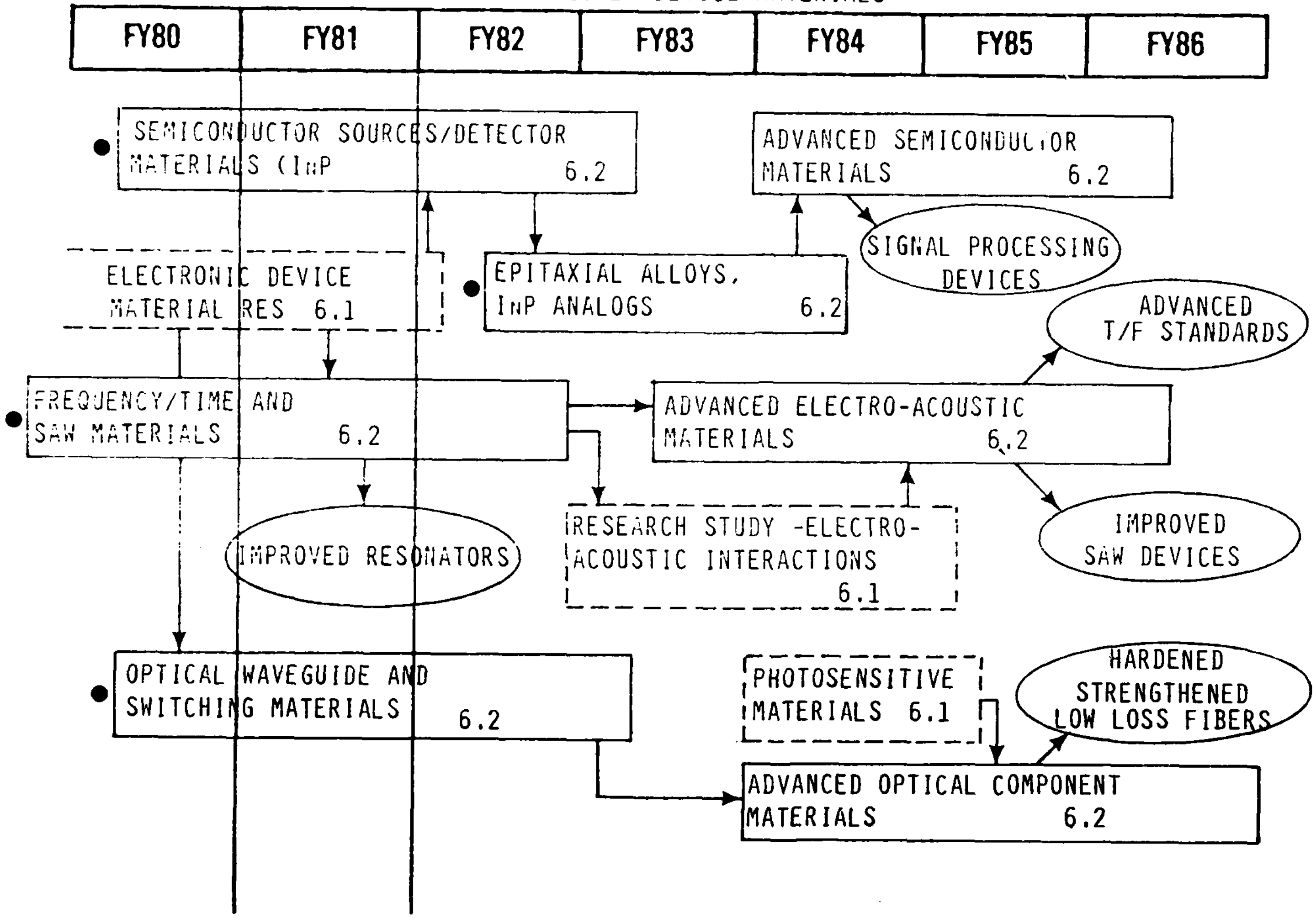
SOLID STATE DEVICES

EM DEVICE MATERIALS

INDIUM PHOSPHIDE - NEW KID ON THE SEMICONDUCTOR BLOCK

- SOLID STATE MICROWAVE APPLICATIONS
- SOLAR CELLS
- INTEGRATED CIRCUITS
- LATTICE MATCHED ELECTRO OPTIC DEVICES

RADC TPO 4 / TECHNOLOGY
THRUST: D4 / SOLID STATE DEVICES/EM DEVICE MATERIALS



SOLID STATE DEVICES

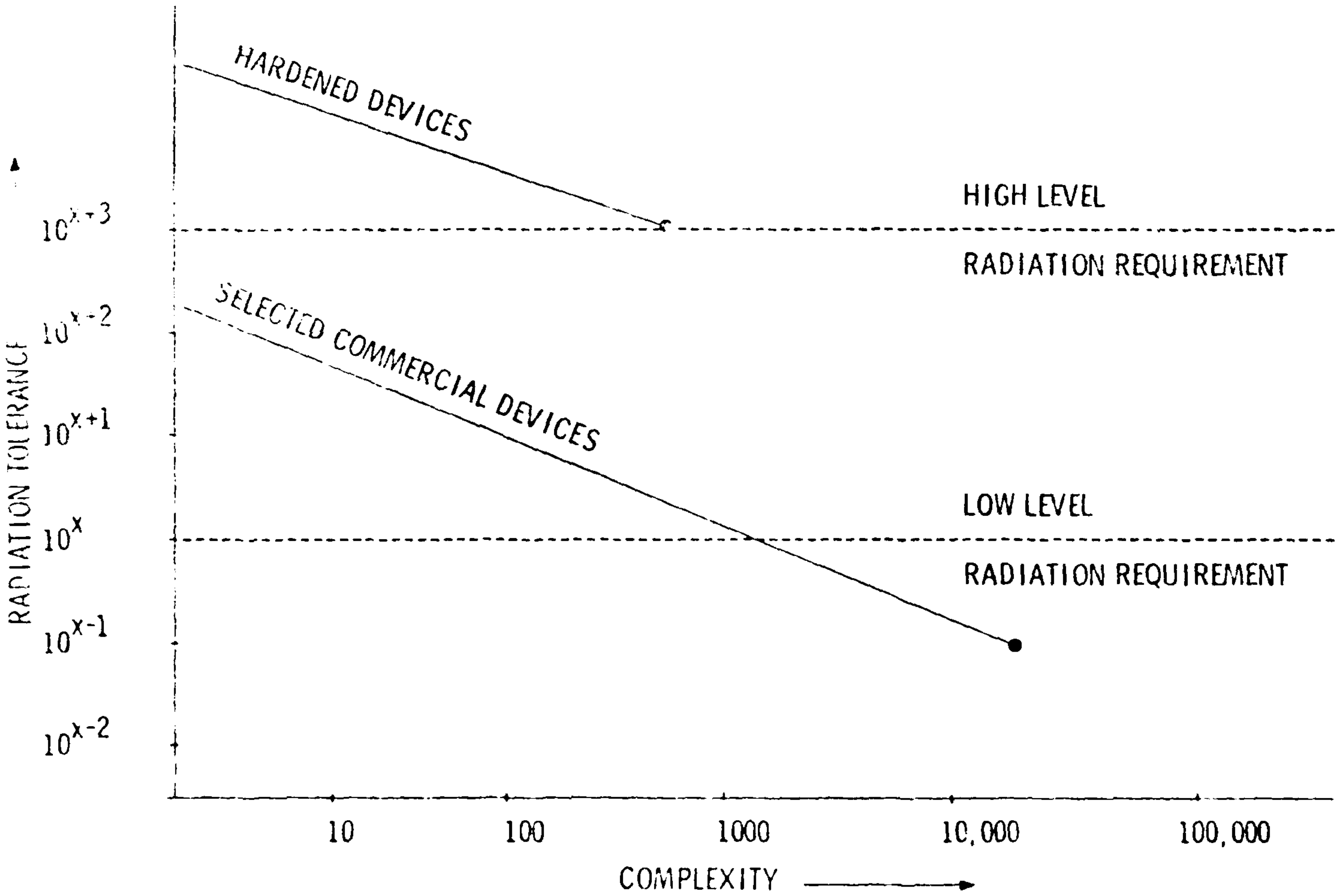
EM DEVICE RADIATION HARDENING - BOBBY BUCHANAN

PROGRAM GOALS:

- o DEVELOP TECHNOLOGY BASE FOR COST EFFECTIVE "HARDENING" OF AF ELECTRONICS
- o DEVELOP RADIATION HARDENED LSI/VLSI/VHSI AND MICROPROCESSORS
- o PROVIDE CONSULTATION, RADIATION TEST AND TECHNOLOGY ASSESSMENTS TO AIR FORCE SYSTEMS OFFICES

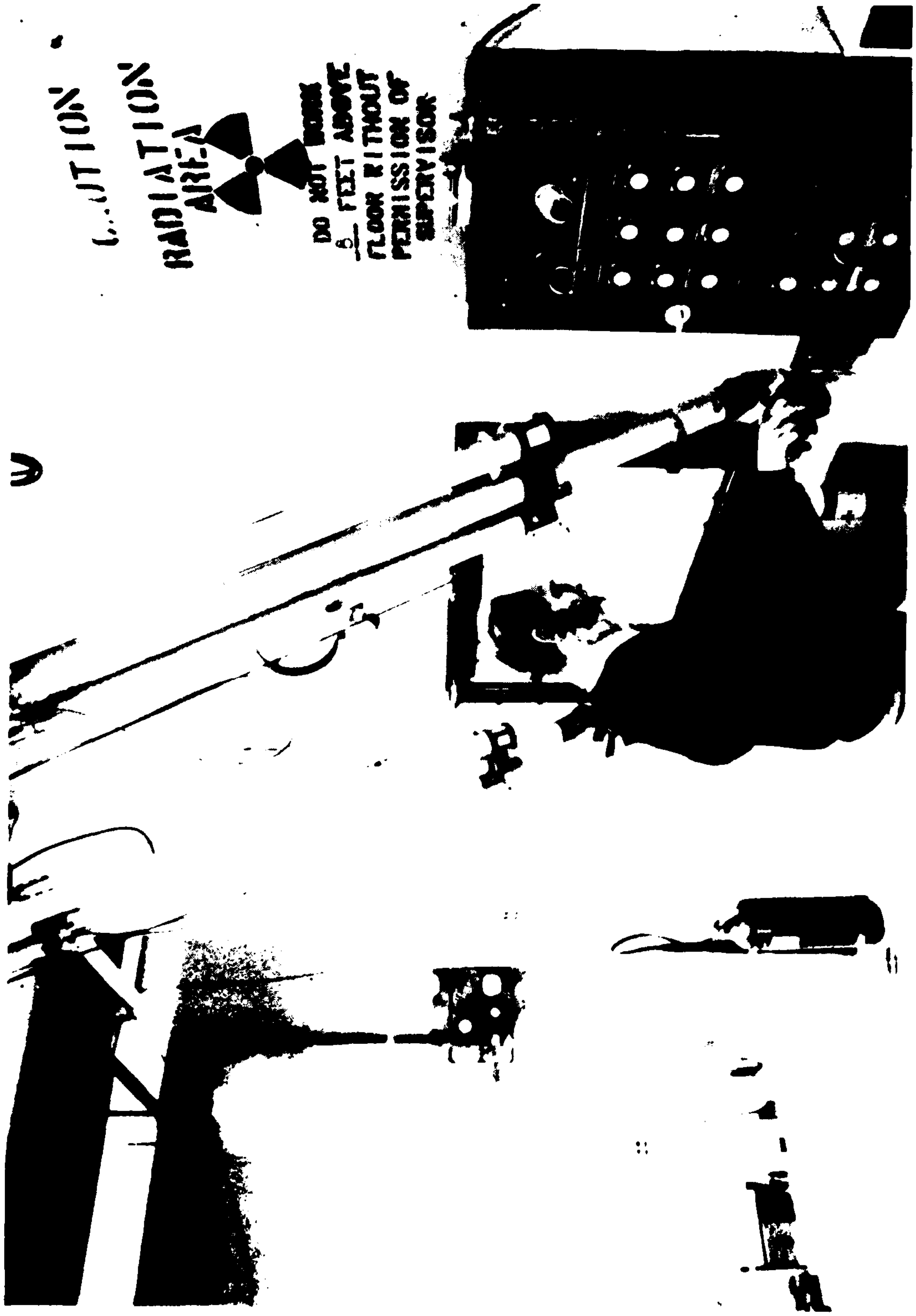
TECHNICAL AREAS:

- o RADIATION EFFECTS
- o HARDENING AND EVALUATION
- o IRRADIATION AND DOSIMETRY



RADIATION TOLERANCE OF MONOLITHIC SEMICONDUCTOR DEVICES AS A FUNCTION OF COMPLEXITY.


RADIATION HARDENED ELECTRONICS TECHNOLOGY
TEST STATION
DESIGN
MICROPROCESSOR TESTER
COBALT 60


RADIATION
AREA
DO NOT WORK
8 FEET ABOVE
FLOOR WITHOUT
PERMISSION OF
SUPERVISOR

SOLID STATE DEVICES

EM DEVICE HARDENING

HARDENED LSI BASIC TECHNOLOGY DEVELOPMENT

OBJECTIVE: TO DEVELOP THE UNDERLYING TECHNOLOGIES WHICH ARE COMMON TO HARDENED INTEGRATED CIRCUITS - THIS INCLUDES ALL DIELECTRIC ISOLATION TECHNOLOGIES. TO DEVELOP INTRINSICALLY HARD INTEGRATED CIRCUIT STRUCTURES.

TECHNICAL APPROACH:

- STANDARDIZED DIELECTRIC ISOLATION DEVELOPMENT
- NOVEL DI TECHNOLOGY FOR FET's
- RADIATION HARD MESFET TECHNOLOGY

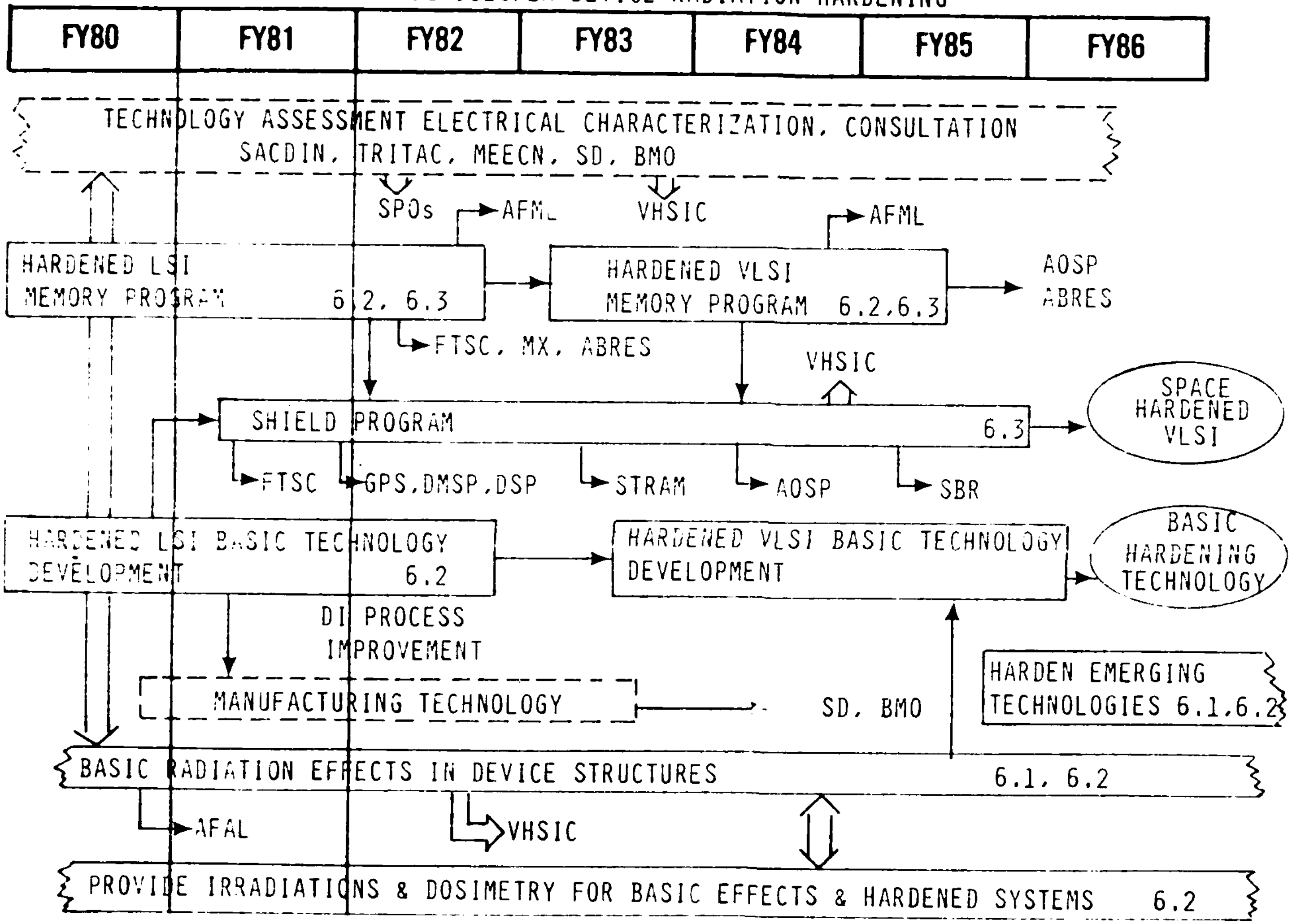
TPO THRUST #/TITLE: 4D / SOLID STATE DEVICES

SUB-THRUST #/TITLE: 5 / EM DEVICE RADIATION HARDENING

MAJOR NON-DL PROGRAMS SUPPORTED

NON-DL PROGRAM	SUPPORT PROVIDED	CUSTOMER
TRITAC	CONSULTATION	ESD
SACDIN	CONSULTATION	ESD
MEECN	CONSULTATION	ESD
MX	CONSULTATION RADIATION TESTING CHARACTERIZATION	BMO
SPACE PROBE	RADIATION TESTING	NASA
FTSC	CONSULTATION RADIATION TESTING HARDENED DEVICE DEVELOPMENT CHARACTERIZATION	SD
VHSIC	CONSULTATION	DOD
61102F	RADIATION RESEARCH	AFOSR

RADC TPO 4 / TECHNOLOGY
THRUST: D5 / SOLID STATE DEVICES/EM DEVICE RADIATION HARDENING



SOLID STATE DEVICES

EM DEVICE HARDENING

SHIELD

(SPACE HARDENED INTEGRATED ELECTRONICS DEVELOPMENT)

PROGRAM

OBJECTIVE: HARDEN LARGE AND VERY LARGE SCALE INTEGRATED CIRCUIT TECHNOLOGIES FOR USE IN SPACE SYSTEMS.

PLAYERS: SD, RADC, DARPA

SCHEDULE: 3 - 5 YEARS TO DEVELOP RADIATION HARDENED VLSI WITH THE COMPLEXITY OF A 64 K-BIT RAM.

PROGRAM CHANGES AND TRENDS

INCREASING EMPHASIS

- High Throughput Signal Processing Devices (CCD)
- Advanced Time and Frequency Standards
- Establishment of Technology Base for Advanced Application of Fiber Optics
- Increased Support to Other RADC Divisions
- Radiation Hardening of Advanced Electronics

- Optical Signal Processing

SURVEILLANCE DIVISION
MINI-SESSION PRESENTATIONS
TUESDAY, 3 JUNE 1980

RADC - BLDG 106 - AUDITORIUM

1:45 PM	SURVEILLANCE ECCM - MR. SHIELDS
	AIR CRAFT IDENTIFICATION - MR. WOLF
3:15 PM	SPACE BASED RADAR - MR. SIMONS
	CRUISE MISSILE SURVEILLANCE - MR. OGRODNIK

TPO/THRUST: 1C / TACTICAL C^3

SUB-SUB-THRUST: 2B / SURVEILLANCE-ECCM

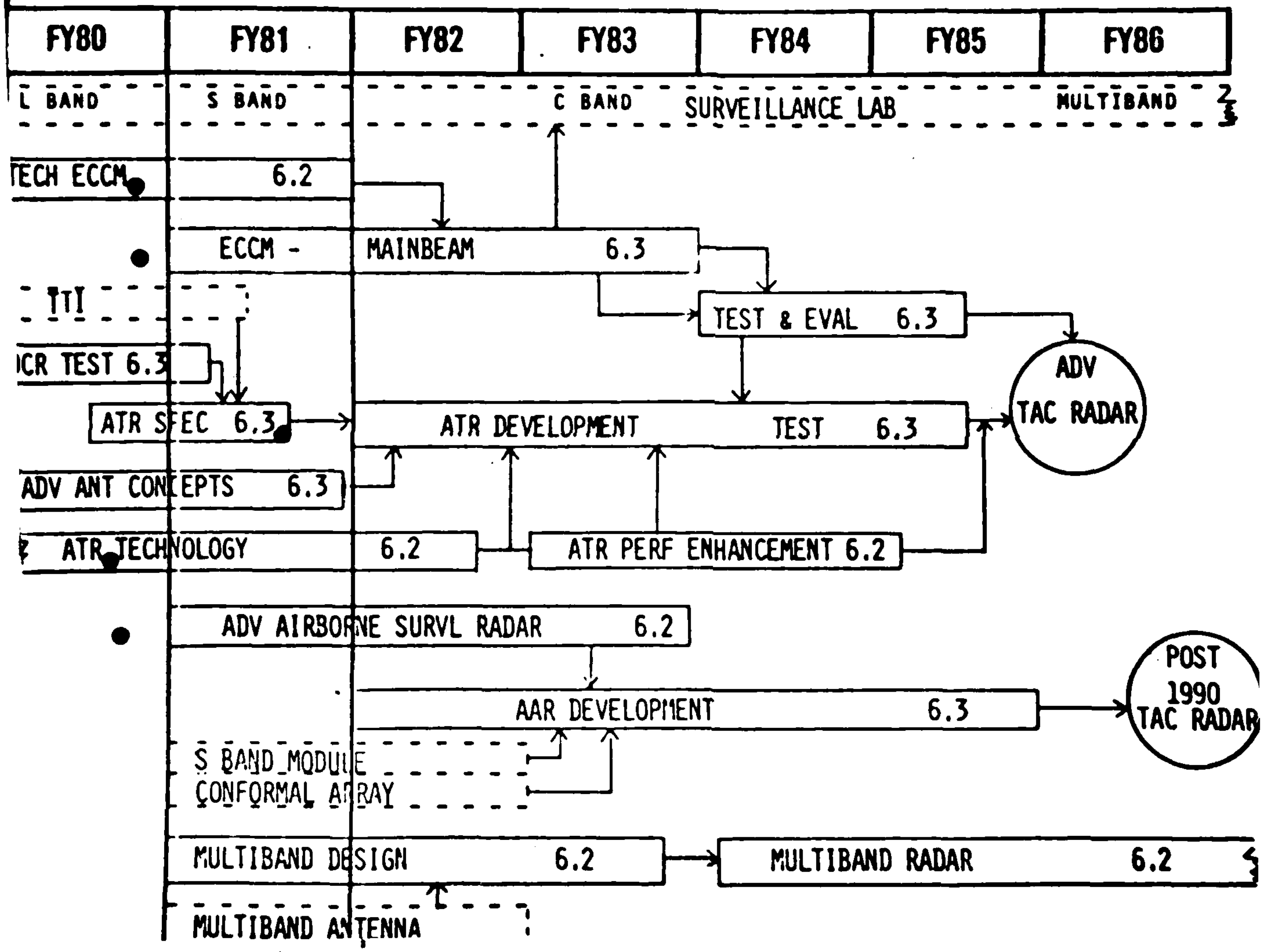
PROGRAM GOALS: DEVELOP AND DEMONSTRATE AN ADVANCED TACS WITH AUTOMATED, DISTRIBUTED COVERAGE CONTROL; AUTOMATED ECCM AND THREAT ADAPTIVITY; AND HIGH SYSTEM SURVIVABILITY.

TECHNICAL AREAS:
- ECCM & RADAR DEVELOPMENT
- RADAR SURVIVABILITY
- SURVEILLANCE SYSTEMS TECHNOLOGY

ANTICIPATED FUNDS: FY81-83 - $20,407,000

RADC TPO 1 C^3

THRUST: C2B TACTICAL C^3/SURVL/SURVL-ECCM/ECCM & RADAR DEVELOPMENT



TPO/THRUST #/TITLE: 1C TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE-ECCM/ECCM & RADAR DEVELOPMENT

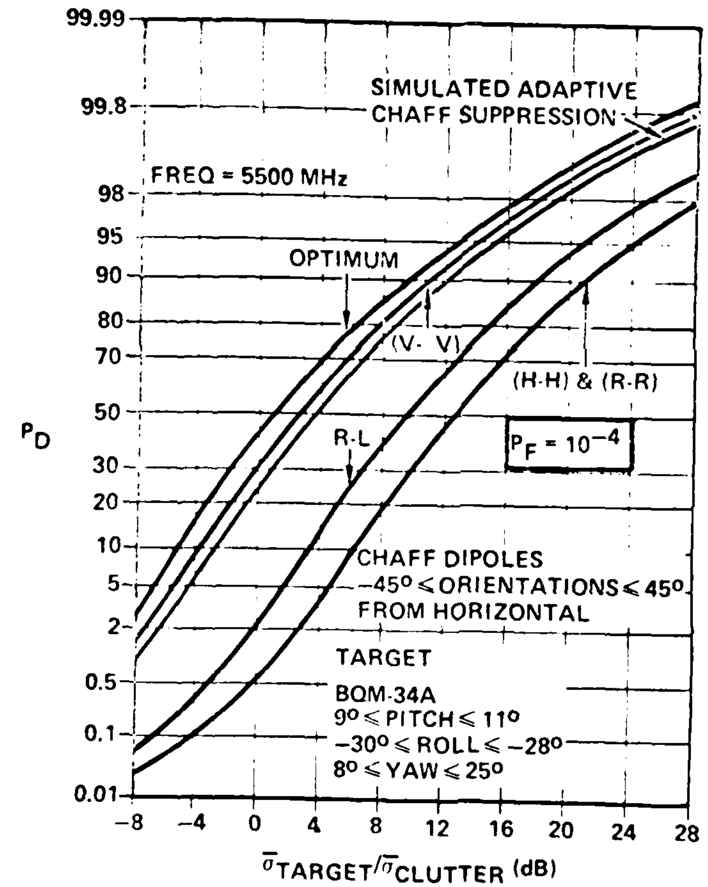
BLOCK TITLE: TECHNOLOGY ECCM

OBJECTIVE: INVESTIGATE AND EVALUATE COUNTER ECM TECHNIQUES FOR APPLICATION TO TACTICALLY DEPLOYED RADARS

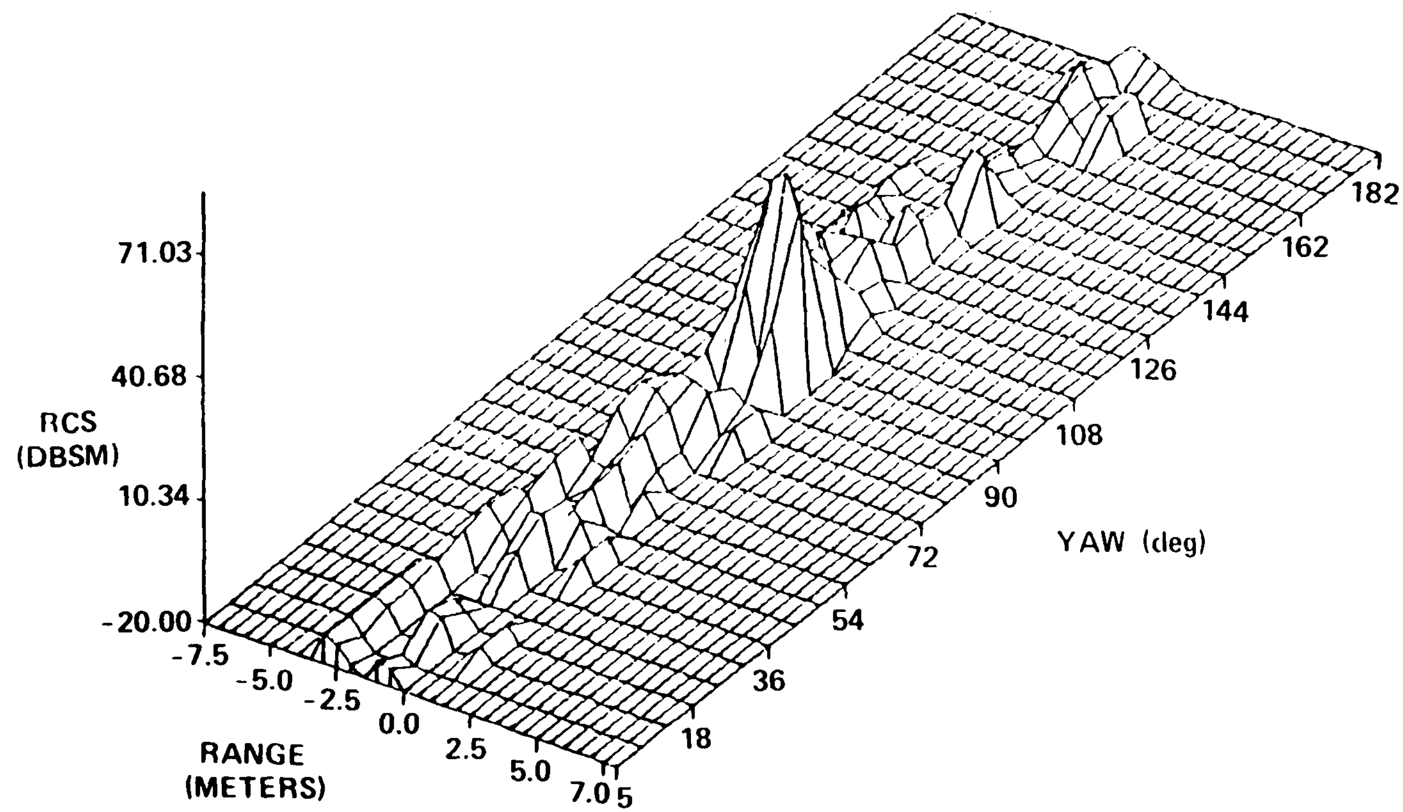
TECHNICAL APPROACH: SELECTION OF CANDIDATE MAINLOBE CANCELLATION TECHNIQUES FOR ANALYSIS AND EXPERIMENTAL VERIFICATION

PAY OFF: PRESENTLY DEPLOYED AND FAR TERM SENSOR WILL BE CAPABLE OF OPERATING IN A HEAVY JAMMING ENVIRONMENT

SINGLE PULSE DETECTION PROBABILITIES FOR VARIOUS (TRANSMIT-RECEIVE) POLARIZATIONS

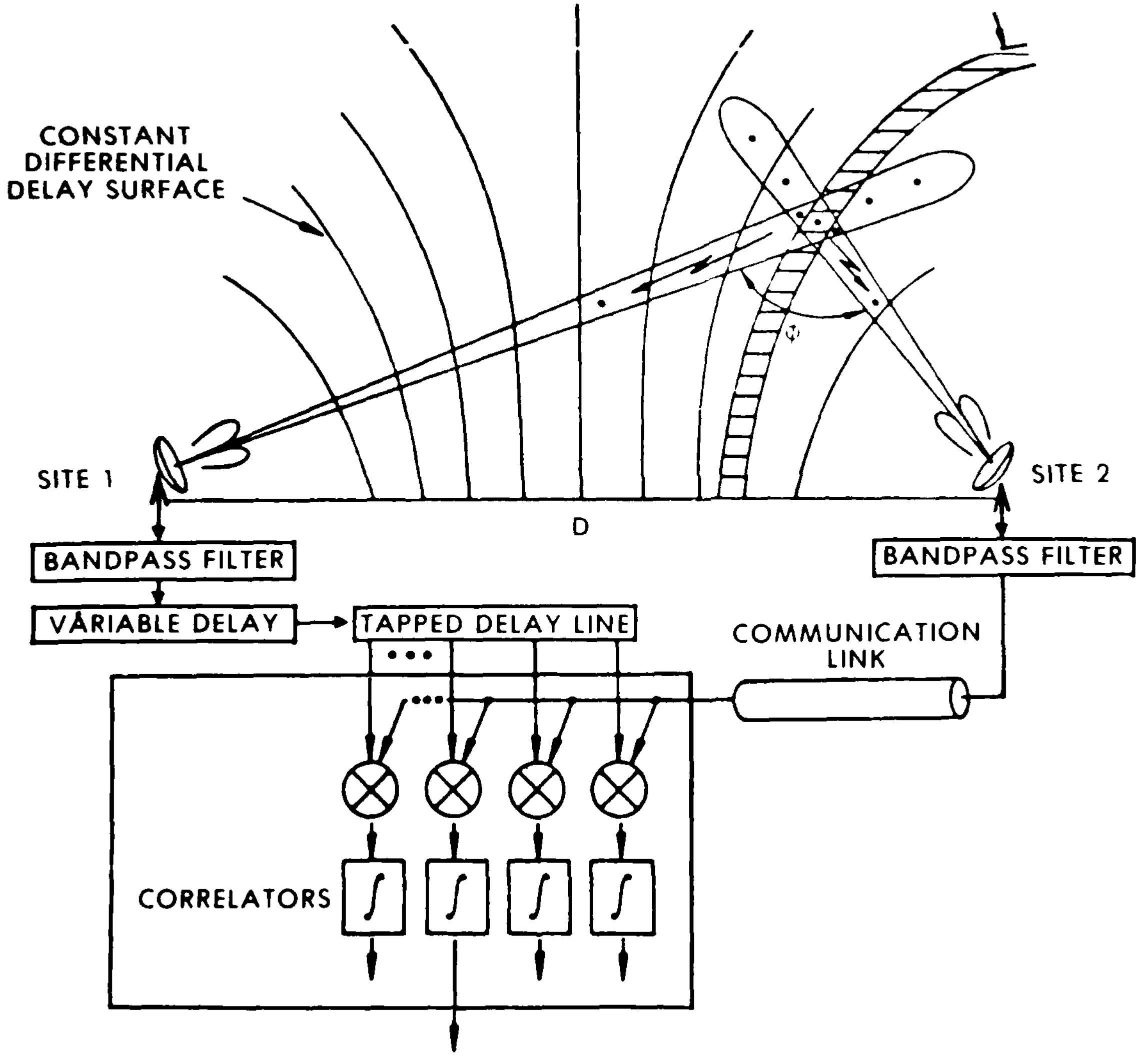


RESPONSE OF BQM-34A SIMULATION MODEL TO 300 MHz GAUSSIAN PULSE



BQM34-A 5500 MHz HH RESPONSE AT 300 MHz BANDWIDTH

JAMMER LOCATION
(VIA CROSS CORRELATION)



TPO/THRUST #/TITLE: 1C TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE ECCM/ECCM & RADAR DEVELOPMENT

BLOCK TITLE: ECCM MAINBEAM

OBJECTIVE: ELIMINATE THE EFFECTS OF MAINBEAM JAMMING VIA POLARIZATION DIVERSITY, BEAM NULLING, ETC.

TECHNICAL APPROACH: DEVELOP & TEST MAINLOBE AND NEAR-IN SIDELOBE CANCELLATION TECHNIQUES VIA USE OF LABORATORY PHASED ARRAY RADAR.

PAY OFF: HIGH. A GOOD SOLUTION TO MAINBEAM JAMMING WILL ALLOW THE DETECTION OF MOST TARGETS PRESENT IN COVERAGE.

TPO THRUST #/TITLE: IC TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE-ECCM/ECCM & RADAR DEVELOPMENT

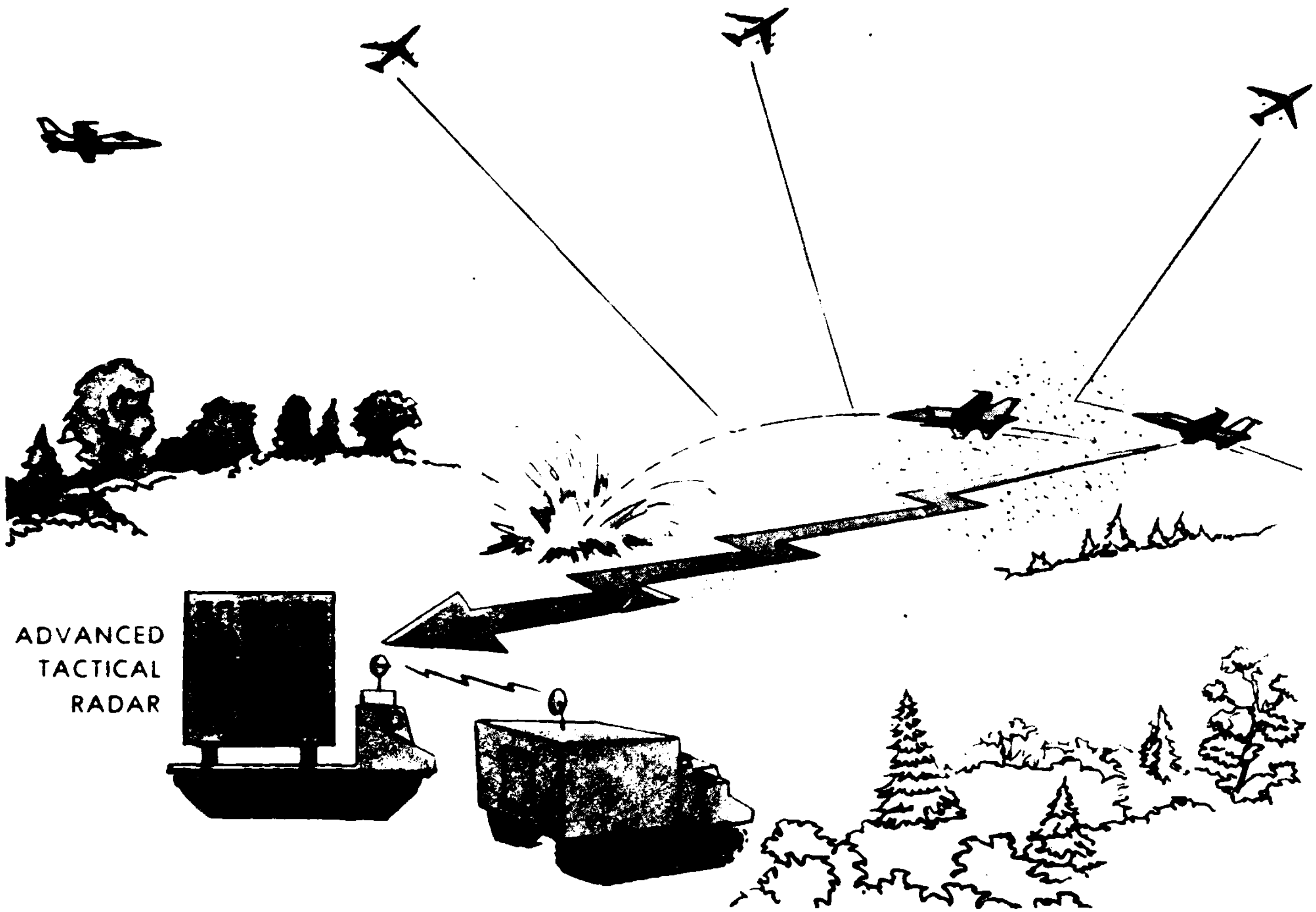
BLOCK TITLE: ADVANCED TAC RADAR DEVELOPMENT

OBJECTIVE: TO DEVELOP MOBILE ADVANCED TACTICAL RADAR TO MEET THE MULTI THREAT ENVIRONMENT OF 1990s

TECHNICAL APPROACH: TO DESIGN, FABRICATE AND FULLY TEST TWO ADVANCED TACTICAL RADAR DIVERGENT DESIGN (S-BAND, C-BAND) RADAR MODELS

PAY OFF: SENSOR TO BE DEVELOPED TO MEET ADVANCED ENEMY THREAT AND MISSION REQUIREMENTS OF 1990s WHICH PRESENT RADARS CANNOT COPE WITH

TACTICAL AIR SURVEILLANCE



ADVANCED TACTICAL RADAR

- MOBILE LONG RANGE SURVEILLANCE RADAR WITH MULTIPLE TRACK + IDENTIFICATION MODES
- VERSATILE WAVEFORMS FOR OPTIMIZED PERFORMANCE + ENHANCED SURVIVABILITY
- ON-BOARD DATA PROCESSING FOR AUTONOMOUS AND NETTED OPERATION
- GRACEFUL DEGRADATION
- MOBILE DESIGN

TPO THRUST #/TITLE: 1C TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE-ECCM/ECCM & RADAR DEVELOPMENT

BLOCK TITLE: ADVANCED TAC RADAR TECHNOLOGY

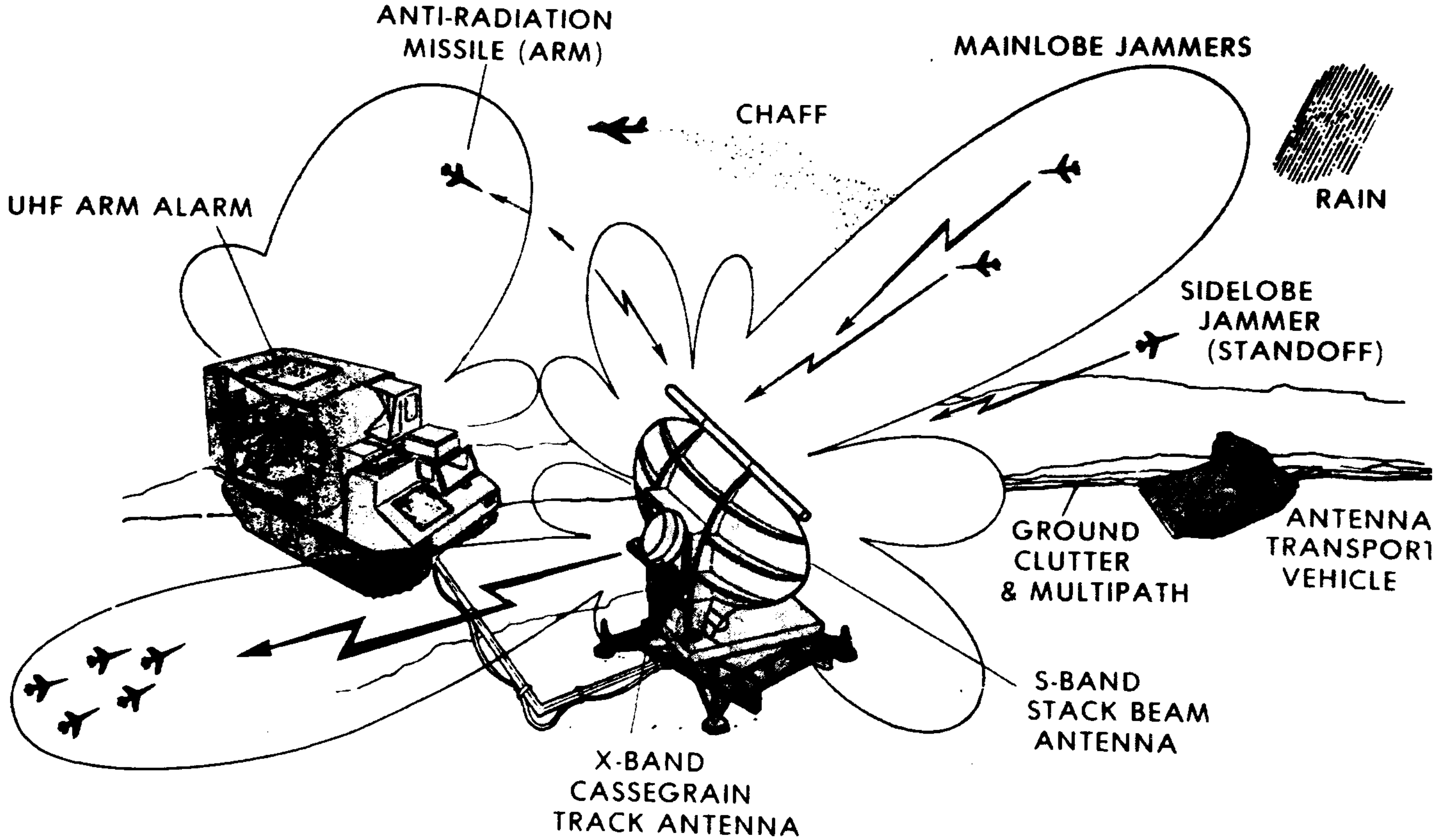
OBJECTIVE: TO DEVELOP REQUIRED TECHNOLOGY IN SUPPORT OF THE MOBILE ADVANCED TACTICAL RADAR PROGRAM

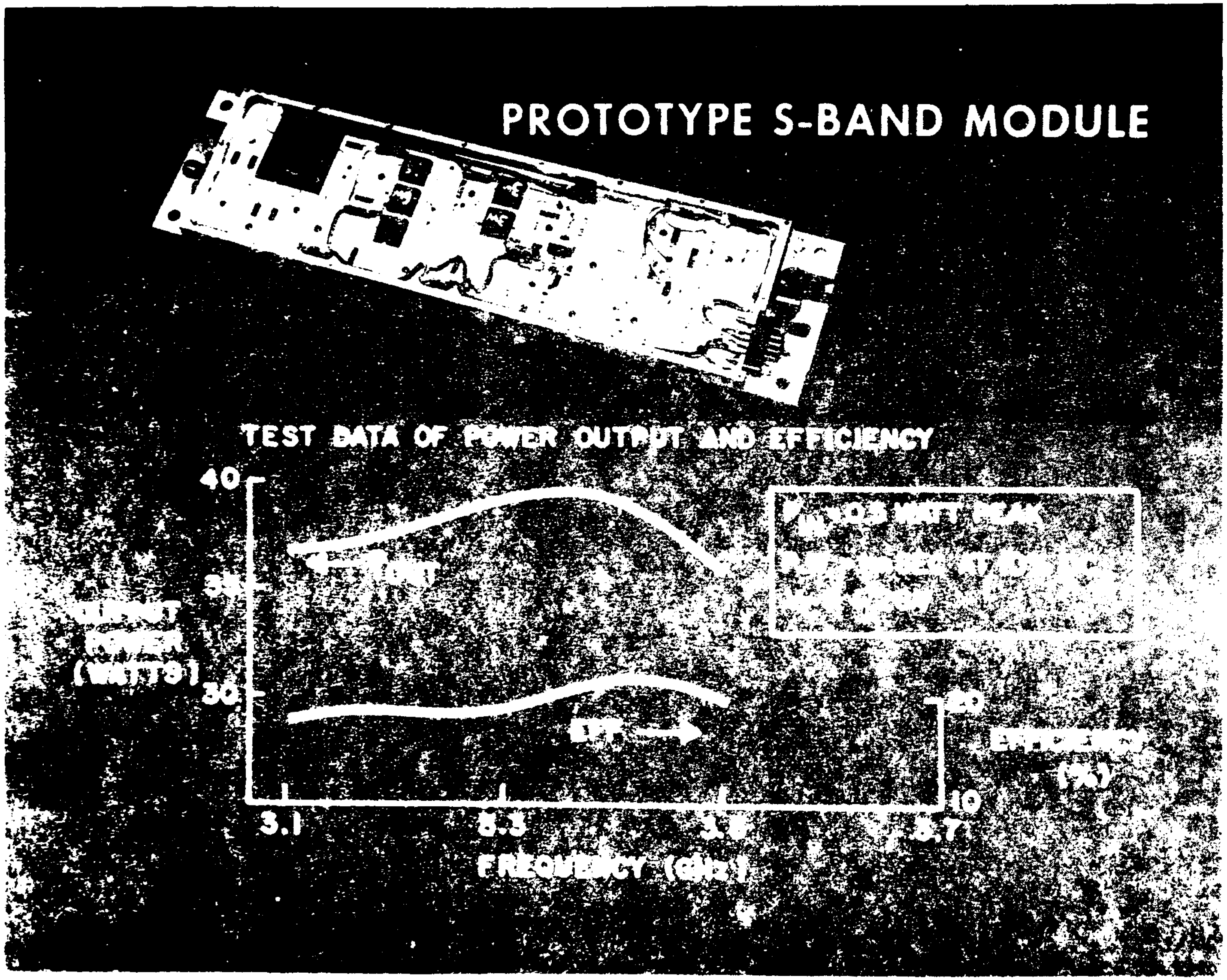
TO DEVELOP HIGH PAY OFF TECHNOLOGY TO ENHANCE PERFORMANCES OF THE ATR

TECHNICAL APPROACH: DEVELOP ADAPTIVE POLARIZATION CAPABILITY, RADAR/COMM INTEGRATION, SOLID STATE MODULES, MULTIPLE SITE TRACKING ALGORITHMS

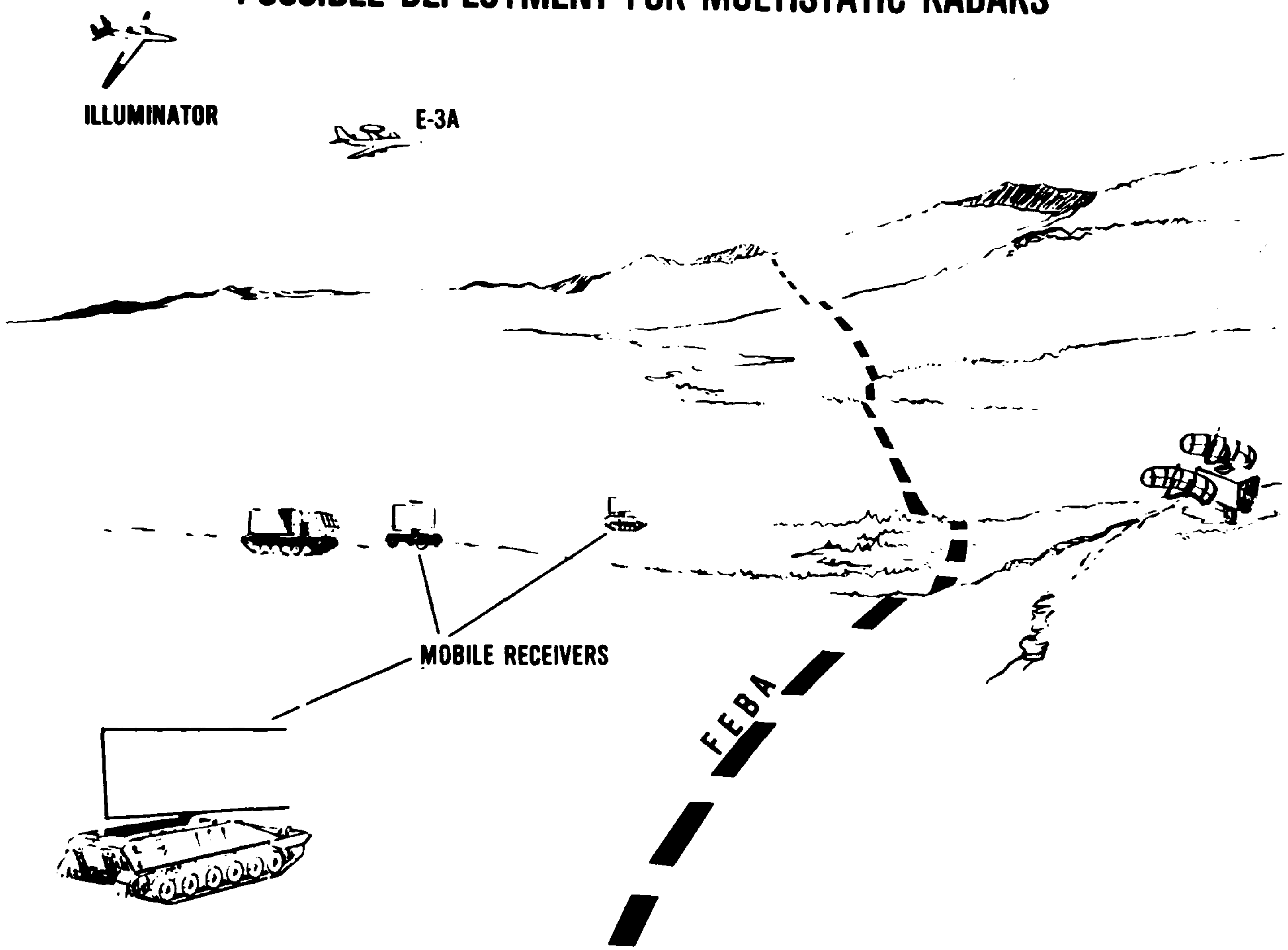
PAY OFF: PROVIDE A MAXIMUM SELECTION OF DESIGN OPTIONS FOR ENGINEERING MODEL APPLICATION

TACTICAL RADAR TECHNOLOGY CONCEPTS




PROTOTYPE S-BAND MODULE
TEST DATA OF POWER OUTPUT AND EFFICIENCY
40
30
20
10
3.1
3.3
3.7
FREQUENCY (GHz)

POSSIBLE DEPLOYMENT FOR MULTISTATIC RADARS



TPO THRUST #/TITLE: 1C TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE-ECCM/ECCM & RADAR DEVELOPMENT

BLOCK TITLE: ADVANCED AIRBORNE SURVEILLANCE RADAR

OBJECTIVE: INVESTIGATE NEW AND PROMISING TECHNOLOGY IN SUPPORT OF ADVANCED AIRBORNE SURVEILLANCE RADAR

TECHNICAL APPROACH: ESTABLISH BASELINE RADAR DESIGN. DEVELOP-EXPAND HIGH RISK COMPONENTS I.E. ANT. SOLID STATE MODULES - BUILD ADVANCED DEVELOPMENT MODEL

PAY OFF: HIGH PAY OFF IN MULTI THREAT ENVIRONMENT

TPO THRUST #/TITLE: 1C TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE-ECCM/ECCM & RADAR DEVELOPMENT

BLOCK TITLE: MULTIBAND DESIGN

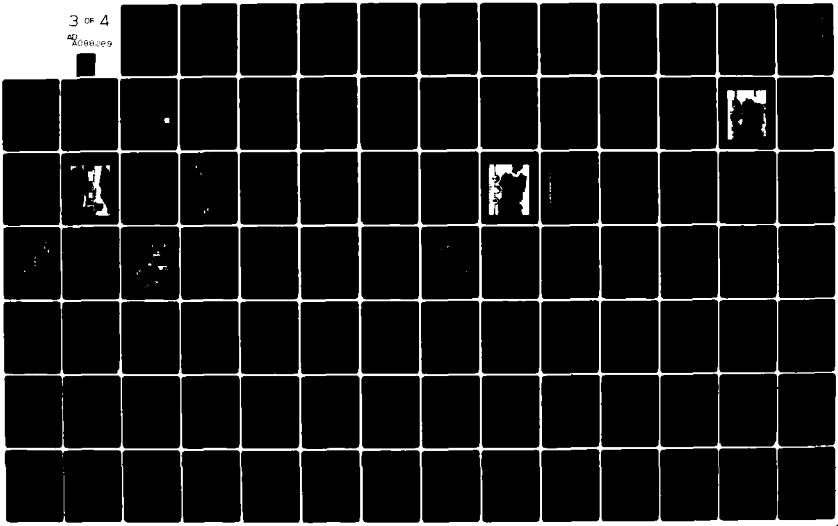
OBJECTIVE: INVESTIGATE NEW AND PROMISING TECHNOLOGY IN SUPPORT OF A MULTI BAND RADAR

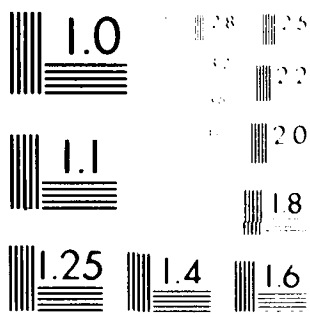
TECHNICAL APPROACH: INVESTIGATE CANDIDATE LOW SIDELOBE MULTI BAND AGILE BEAM ANTENNA TECHNIQUES WITH SOLID STATE, OCTAVE BAND TRANSMITTER DEVELOPMENTS

PAY OFF: HIGH PAY OFF IN MULTI THREAT ENVIRONMENT WITH INCREASED ECCM CAPABILITY. HIGHER SEARCH AND TRACK RATES, COMM CAPABILITY, JAMMER.

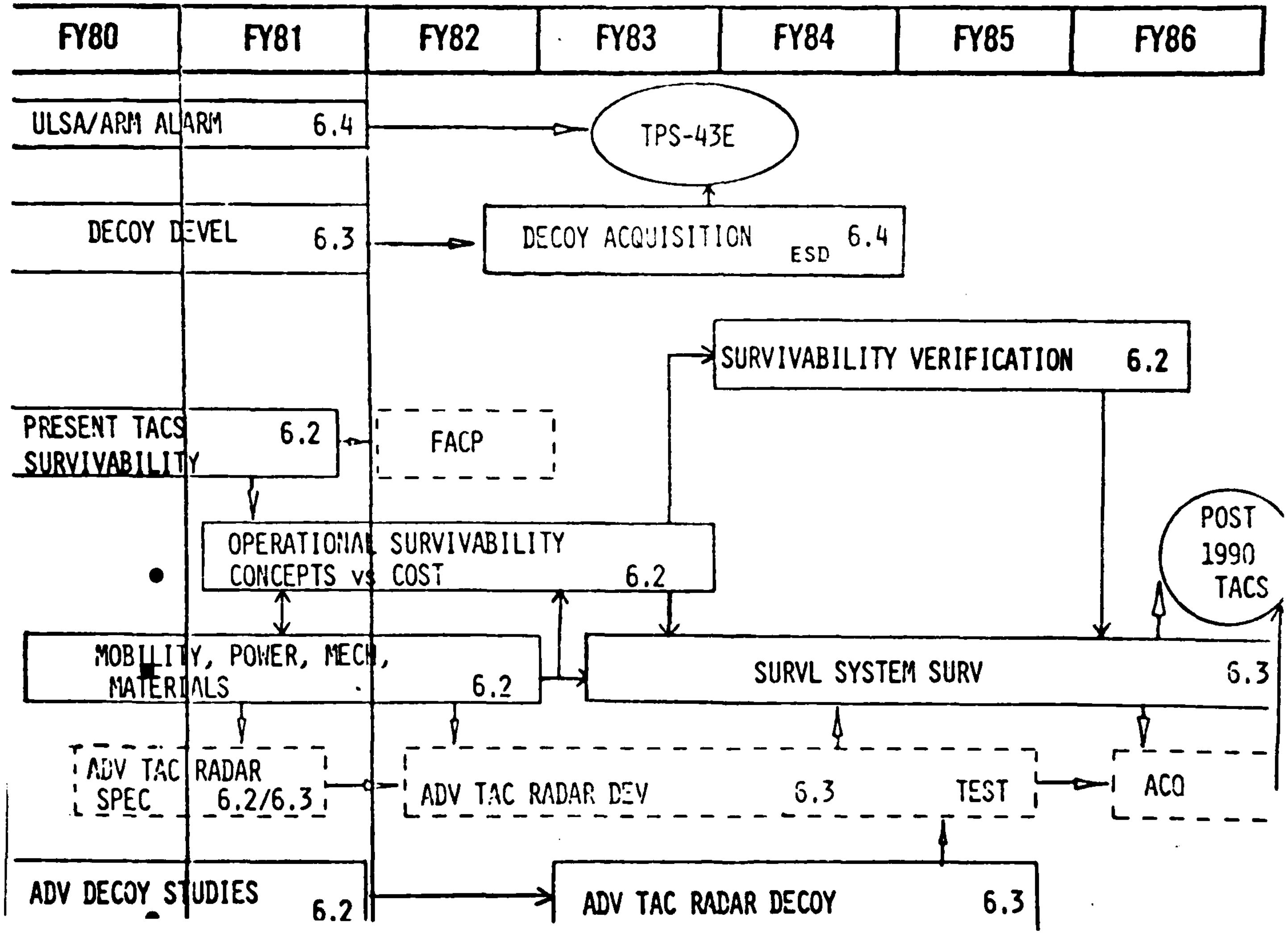
AD-A088 289 ROME AIR DEVELOPMENT CENTER GRIFFISS AFB NY F/G 5/1
INDUSTRY LOOKS AT RADC - 1980. VOLUME I.(U)
1980
UNCLASSIFIED RADC-TR-80-195-VOL-1 NL

3 OF 4
AD A088289




1.0
2.8
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

RADC TPO
THRUST: 1 C^3 C2B TACTICAL C^3/SURVL/SURVL-ECCM/RADAR SURVIVABILITY



TPO THRUST #/TITLE: 1C TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE-ECCM/RADAR SURVIVABILITY

BLOCK TITLE: OPERATIONAL SURVIVABILITY CONCEPTS vs COST

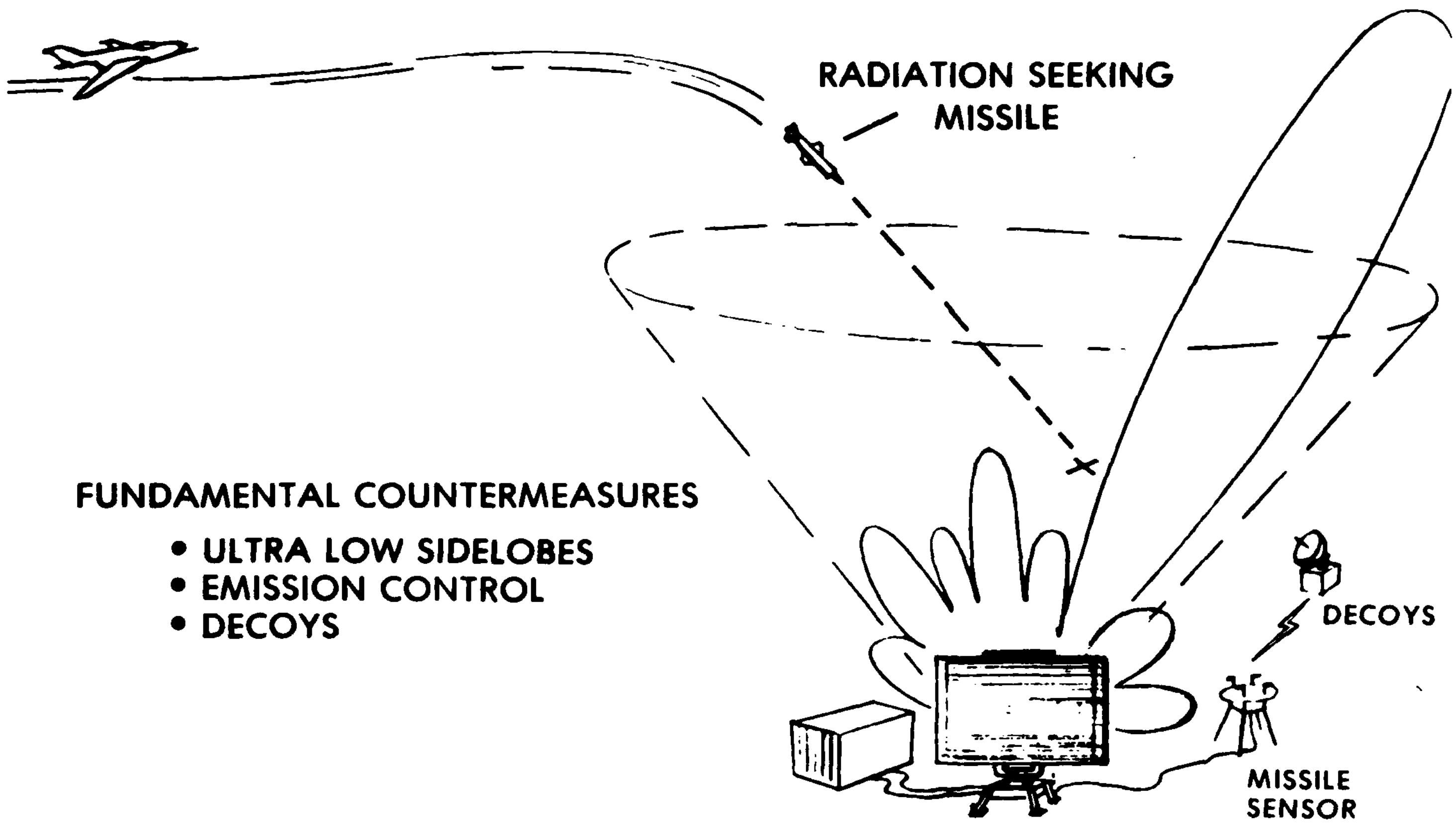
OBJECTIVE: TO DEVELOP SURVIVABILITY MODELS SUCH AS FOR THE ADVANCED TACTICAL RADAR SURVIVABILITY SPECIFICATION.

TECHNICAL APPROACH: CONDUCT A MULTIPLE THREAT ANALYSIS, I.E. ARMS, RF & IR, GUIDED BOMBS ETC. AND DERIVE SURVIVABILITY CONCEPTS, I.E. DECOYS, MOBILITY, CAMOUFLAGE, NEAR MISS HARDNESS.

DETERMINE PROBABILITY OF SURVIVAL vs COST.

PAY OFF: ENHANCED SURVIVABILITY OF FUTURE MOBILE TAC's.

ANTI-ARM



FUNDAMENTAL COUNTERMEASURES

- ULTRA LOW SIDELOBES
- EMISSION CONTROL
- DECOYS

TPO THRUST #/TITLE: 1C TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE-ECCM/RADAR SURVIVABILITY

BLOCK TITLE: MOBILITY, POWER, MECHANICAL & MATERIALS

OBJECTIVE: OBTAIN LIGHT WEIGHT, EFFICIENT PRIME POWER AND ENVIRONMENTAL CONTROL UNITS FOR FULL SUPPORT OF ADVANCED TACTICAL RADAR MOBILITY REQUIREMENTS.

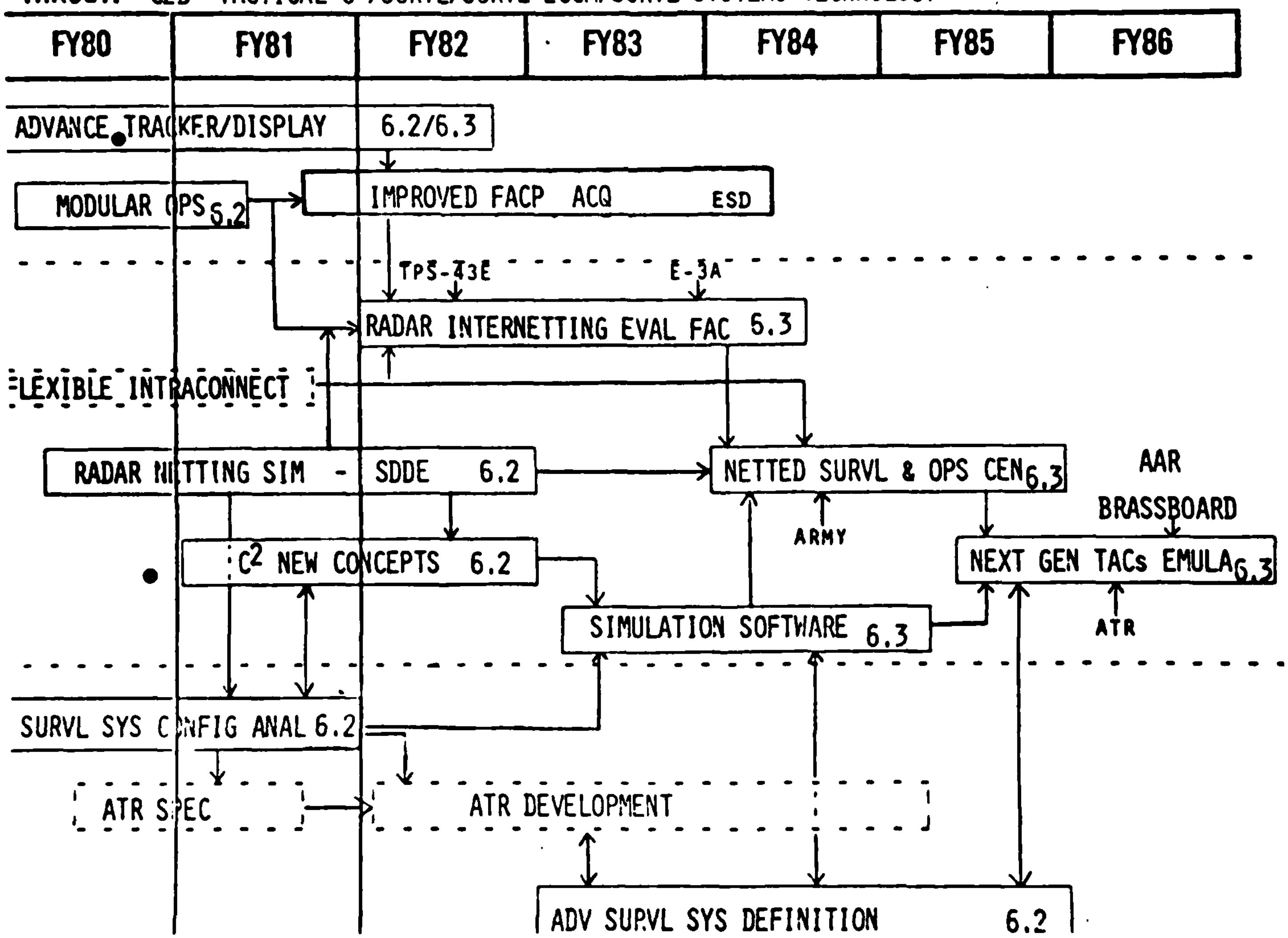
TECHNICAL APPROACH:

- DETERMINE THE AVAILABILITY AND CAPABILITY OF PRESENT HARDWARE
- DEVELOP A JOINT AIR FORCE/ARMY PROGRAM TO ADDRESS DEFICIENCIES AND OBTAIN DESIRED END ITEMS.

PAY OFF: HIGH. HIGH MOBILITY WILL BE ACHIEVED.

RADC TPO 1 C^3

THRUST: C2B TACTICAL C^3/SURVL/SURVL-ECCM/SURVL SYSTEMS TECHNOLOGY



TPO/THRUST #/TITLE: 1C TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE-ECCM/SURVL SYSTEMS TECHNOLOGY

BLOCK TITLE: ADVANCED TRACKER/DISPLAY

OBJECTIVE: TO DESIGN, DEVELOP AND TEST AN AUTOMATIC TACTICAL TARGET TRACKER/DISPLAY WHICH IS CAPABLE OF COPING WITH HIGH PERFORMANCE AIRCRAFT IN A HIGH DENSITY THREAT ENVIRONMENT.

TECHNICAL APPROACH: DEVELOP A BRASSBOARD FOR TESTING WITHIN RADC TEST FACILITY.

PAYOFF: INCREASED TRACK CAPACITY OF RADARS WITH IMPROVED OPERATIONAL FLEXIBILITY.

TPO/THRUST #/TITLE: 1C TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE-ECCM/SURVEILLANCE SYSTEM TECHNOLOGY

BLOCK TITLE: RADAR INTERNETTING EVALUATION FACILITY

OBJECTIVE: TEST NETTING, MODULAR AND NEW OPERATIONAL CONCEPTS & PROCEDURES

TECHNICAL APPROACH: PROVIDE MOCK-UP OF MODULAR OPS USING ADVANCED TRACKER DISPLAYS, FLEXIBLE INTRACONNECT FOR DATA BUS, COMM TO SENSORS FOR NETTING AND SOFTWARE.

PAY OFF: HIGH - PROVIDE INTEGRATED TESTING OF NEW TECHNOLOGY WITH NEW OPERATIONAL CONCEPTS IN AN R&D ENVIRONMENT.

TPO/THRUST #/TITLE: 1C TACTICAL C^3

SUB-SUB-THRUST #/TITLE: 2B SURVEILLANCE-ECCM/SURVEILLANCE SYSTEMS TECHNOLOGY

BLOCK TITLE: C^2 NEW CONCEPTS

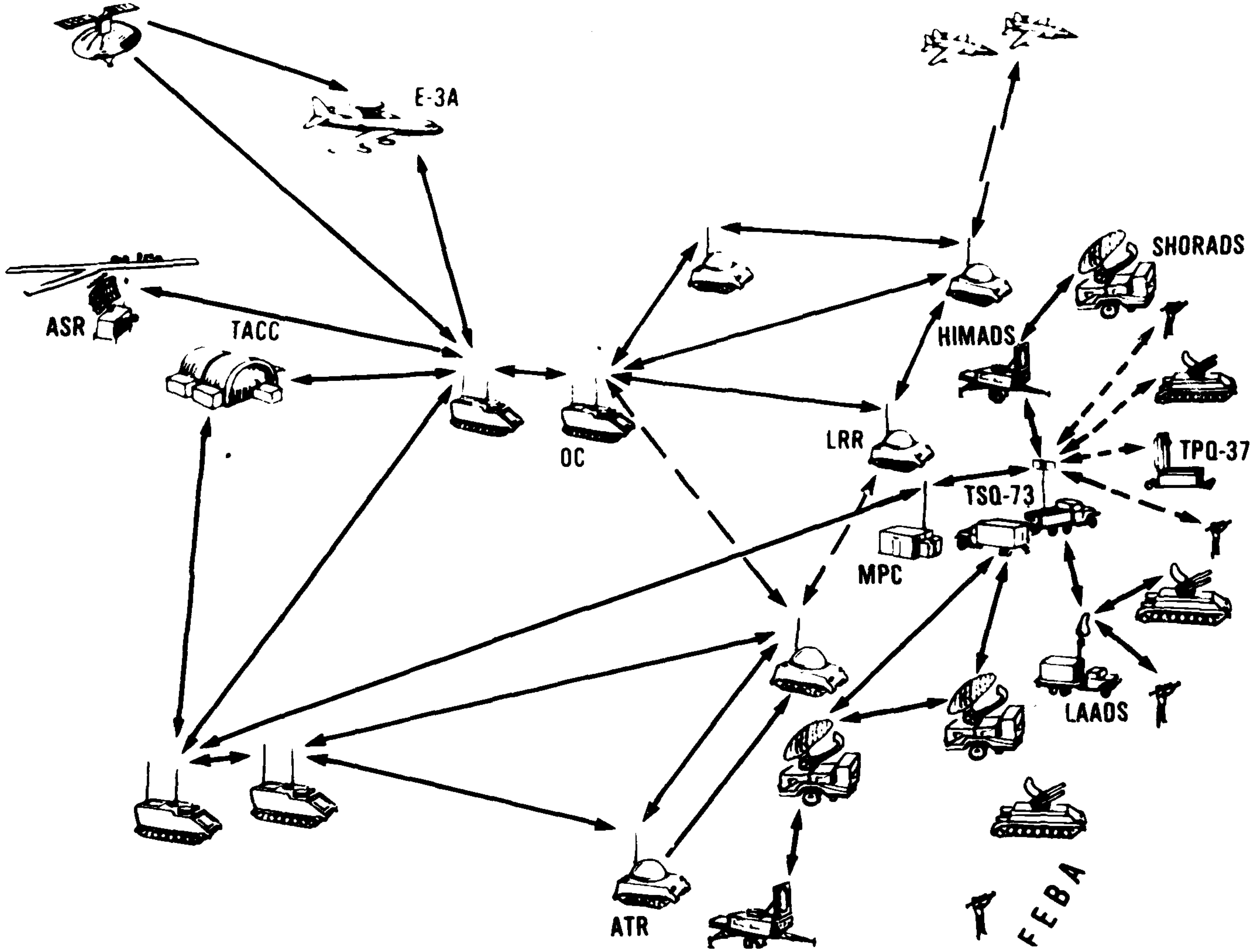
OBJECTIVE: DEVELOP THE INDIVIDUAL AND INTEGRATED CONTROL CONCEPTS FOR AN AUTOMATED SURVEILLANCE SYSTEM.

TECHNICAL APPROACH:

- APPLY MODERN PROCESSING DEVICES AND TECHNIQUES SUCH AS DISTRIBUTED PROCESSING ARRAYS AND ADAPTIVE PROBABILISTIC LOGIC TO PROVIDE AUTOMATED:
  - TARGET TRACKING AND ID
  - ECCM CONTROL
  - INTERELEMENT MESSAGE CONTROL
  - SURVIVABILITY STRATEGY
  - TIME AND ENERGY RESOURCE MANAGEMENT

PAY OFF: HIGH - ALLOWS A HIERARCHY OF CRITICAL DECISIONS TOO RAPID FOR HUMAN ACCOMPLISHMENT

SURVEILLANCE SYSTEM INTERNETTING



SURVEILLANCE ECCM
KEY PROGRAM ENGINEERS

ADVANCED TACTICAL RADAR	THOMAS SHIELDS, OCDR/7684
RADAR INTERNETTING	SAM HART, OCDE/4515
RADAR SURVIVABILITY	ROBERT MATHER, OCDS/4049
RADAR ECCM	JOSEPH MASSOUD, OCDR/4496
ADVANCED AIRBORNE SURVEILLANCE RADAR	RICHARD ACKLEY, OCDE/4441
SIMULATION	GEORGE ELLIS, OCDE/4496
TACTICAL RADAR ANTENNAS	DONALD HILDEBRAND, OCDR/4496

SURVEILLANCE DIVISION

MINI-SESSION PRESENTATIONS

TUESDAY, 3 JUNE 1980

RADC - BLDG 106 - AUDITORIUM

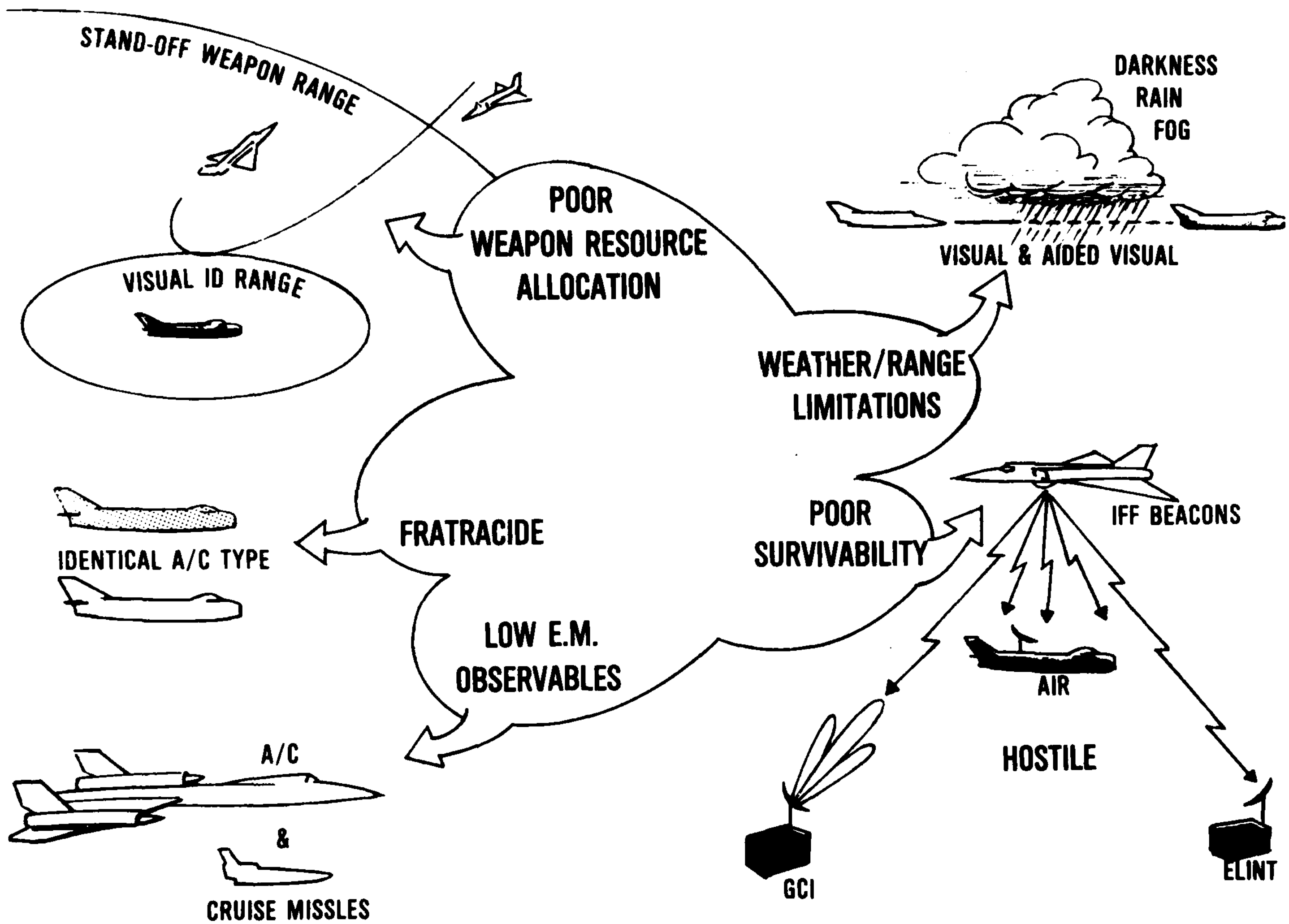
1:45 PM SURVEILLANCE ECCM - MR. SHIELDS

- AIR CRAFT IDENTIFICATION - MR. WOLF

3:15 PM SPACE BASED RADAR - MR. SIMONS

CRUISE MISSILE SURVEILLANCE - MR. OGRODNIK

ASSESSMENT OF AIRCRAFT IDENTIFICATION PROBLEM



TPO/THRUST: 1C/TACTICAL C^3

SUB-THRUST/SUB SUB-THRUST: 2A/SURVEILLANCE AIRCRAFT IDENTIFICATION

PROGRAM GOALS:

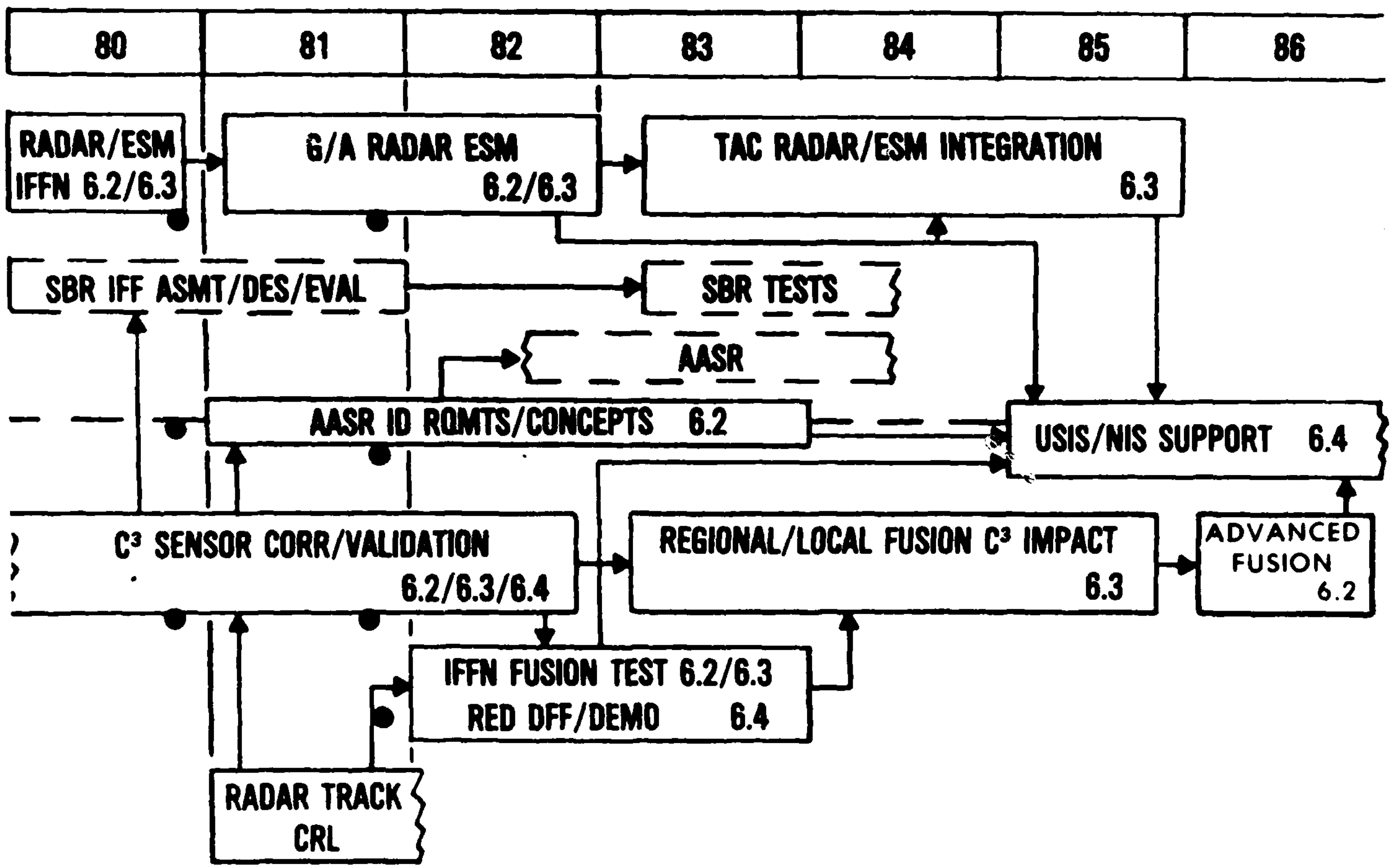
- PROVIDE LONG RANGE, ALL WEATHER, REAL-TIME IDENTIFICATION OF FRIENDLY, HOSTILE & NEUTRAL AIRCRAFT

TECHNICAL AREAS:

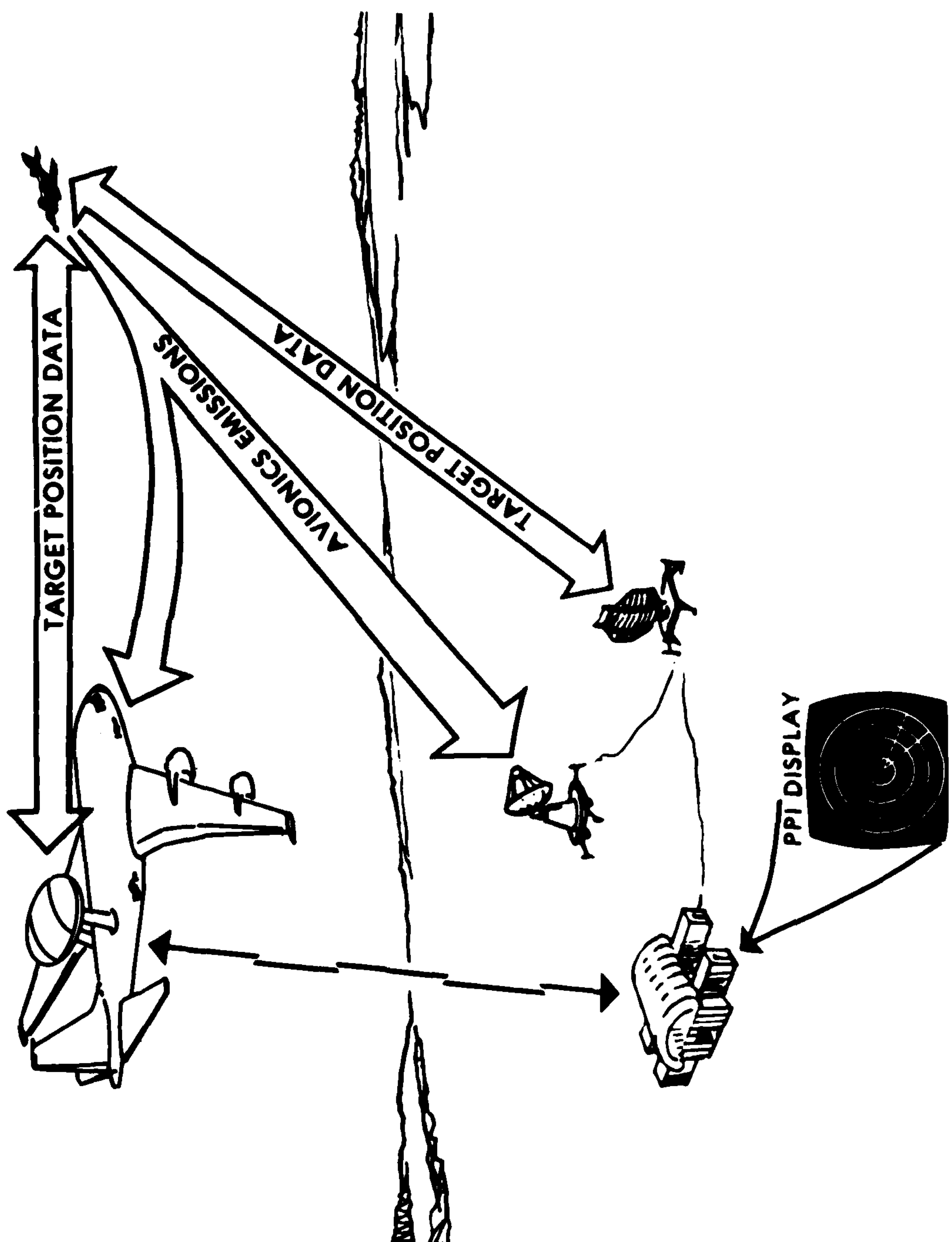
- RADAR/ESM CORRELATION TEST & EVALUATION
- C^3 ID DATA CORRELATION/VALIDATION

TOTAL FUNDS FY80-83 12.5M - 13.1M

RADC TPO THRUST: 1C/TACTICAL C³
2A/SURVEILLANCE AIRCRAFT IDENTIFICATION



G/A RADAR ESM


TARGET POSITION DATA
AVIONICS EMISSIONS
TARGET POSITION DATA
PPI DISPLAY

TPO/THRUST: 1C/TACTICAL C^3

SUB-THRUST/SUB SUB-THRUST: 2A/SURVEILLANCE AIRCRAFT IDENTIFICATION

BLOCK TITLE: G/A RADAR ESM

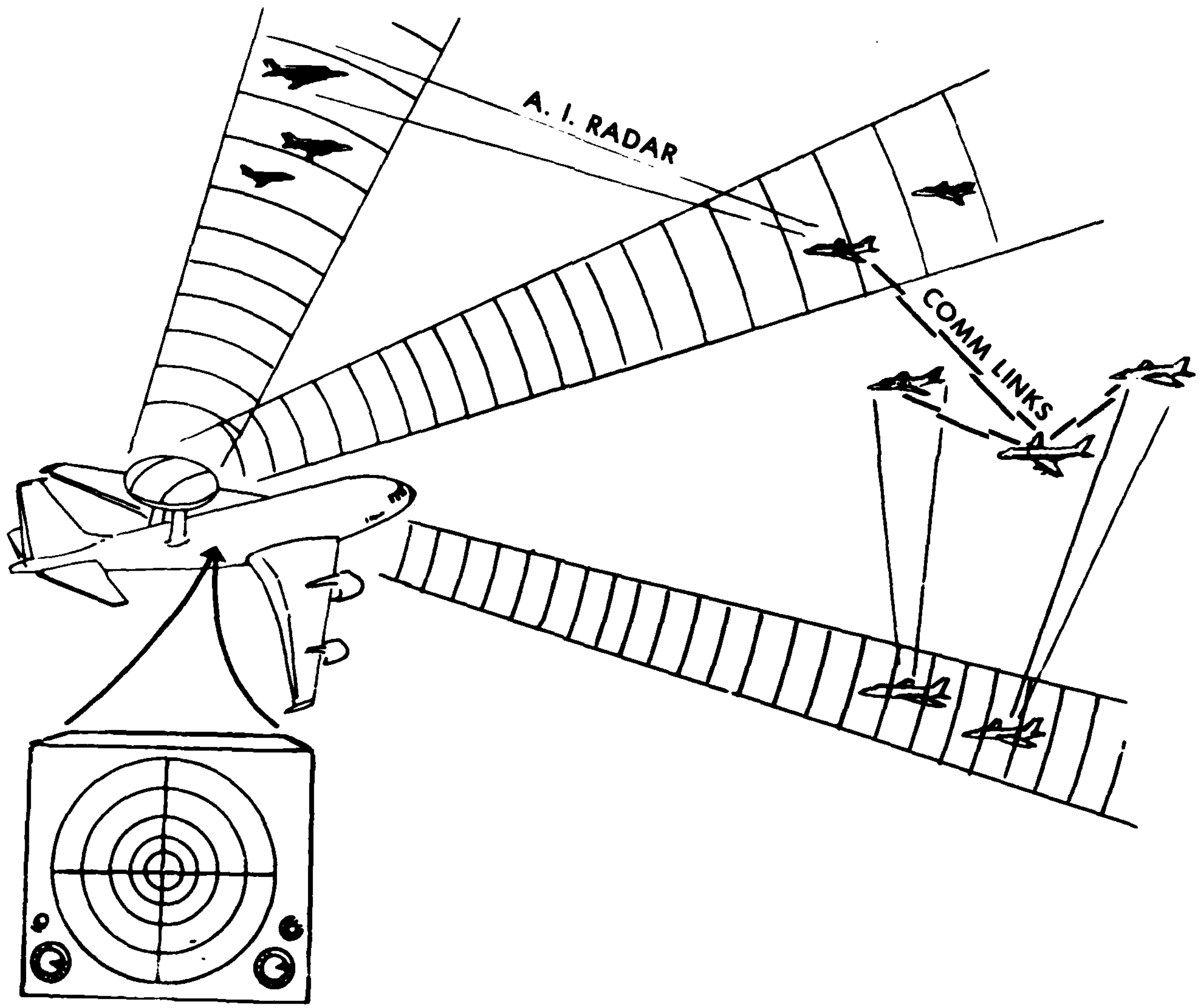
OBJECTIVE: OBTAIN LONG RANGE ID THROUGH CORRELATED RADAR & ESM SENSOR DATA

TECHNICAL APPROACH:

- INTEGRATION OF A/B RADAR/SIGINT WITH G/B RADAR ESM DATA
- EVALUATION OF REAL-TIME IFF CAPABILITY
- DETERMINATION OF DEGREE OF CORROBORATION
- EVALUATION OF EARLY WARNING CUEING OF GROUND ASSETS & POTENTIAL SORTING PAYOFFS
- POTENTIAL DEMONSTRATION OF A/B DATA AUGMENTING GROUND EXPERIMENT

PAYOFF: NEAR TERM ENHANCED ID CAPABILITY FOR C^3 SYSTEM

AASR ID REQUIREMENTS/CONCEPTS



TPO/THRUST: 1C TACTICAL C^3

SUB-THRUST/SUB SUB-THRUST: 2A/SURVEILLANCE AIRCRAFT IDENTIFICATION

BLOCK TITLE: ADVANCED AIRBORNE SURVEILLANCE RADAR ID REQUIREMENTS

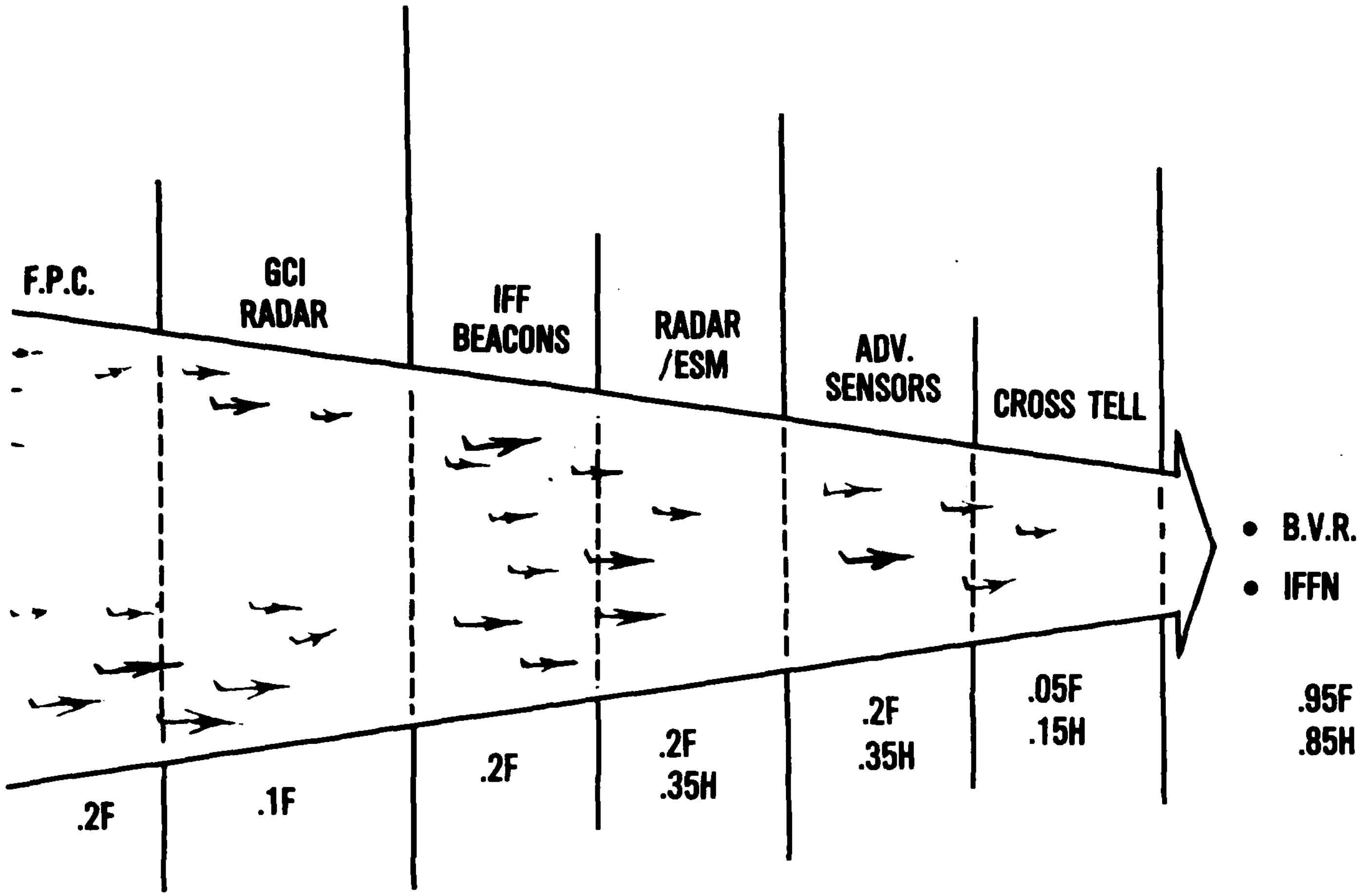
OBJECTIVE: ASSESS REQUIREMENTS & FORMULATE ID CONCEPTS FOR ADVANCED AIRBORNE SURVEILLANCE RADAR

TECHNICAL APPROACH:

- ADVANCED AIRBORNE SURVEILLANCE RADAR ID REQUIREMENTS ANALYSIS
- TECHNOLOGY ASSESSMENTS
- SYSTEM IMPACT

PAYOFF: LONG RANGE ID CAPABILITY FOR ADVANCED AIRBORNE SURVEILLANCE RADAR

RATIONALE FOR MULTI-SENSOR APPROACH



TPO/THRUST: 1C TACTICAL C^3

SUB-THRUST/SUB SUB-THRUST: 2A/SURVEILLANCE AIRCRAFT IDENTIFICATION

BLOCK TITLE: C^3 SENSOR CORRELATION/VALIDATION

OBJECTIVE: ANALYSIS, SIMULATION & VALIDATION OF INDIRECT ID SUBSYSTEM

TECHNICAL APPROACH:

- SIMULATION & ANALYSIS OF INTEGRATED C^3I CONCEPT FOR FUSING ID INFORMATION FROM DISTRIBUTED SENSORS & SOURCES
  - SENSORS INCLUDE E-3A, TPS-43E, & SIGINT
- DEVELOP DATA MANAGEMENT REQUIREMENTS
- DEVELOP FUSION ALGORITHMS
- VALIDATE THROUGH DEMONSTRATION

PAYOFF: HIGHLY EFFICIENT AIR SPACE MANAGEMENT CAPABILITY IN MULTI-NATIONAL ENVIRONMENT WITH ADVERSE FORCE RATIOS

TPO/THRUST: 1C/TACTICAL C^3

SUB-THRUST/ SUB SUB-THRUST: 2A/SURVEILLANCE AIRCRAFT IDENTIFICATION

BLOCK TITLE: IFFN FUSION TEST BED DEF/DEMO

OBJECTIVE: DEVELOPMENT OF EMULATION & HARDWARE TEST BED FOR VALIDATION OF MULTI-SENSOR DATA CORRELATION TECHNOLOGIES

TECHNICAL APPROACH:

- INTEGRATION OF CURRENT TAC SENSOR & DATA PROCESSING HARDWARE INTO SURVEILLANCE SYSTEMS SIMULATION/ EMULATION CAPABILITY
- BRASSBOARD DEVELOPMENT OF PROPOSED SYSTEMS CONCEPTS FOR TESTING & ANALYSIS

PAYOFF:

- REDUCES COSTS/RISKS IN DEVELOPMENT OF FUTURE SYSTEMS CONCEPTS
- DATA BASE FOR DEVELOPMENT & VALIDATION OF SYSTEM ARCHITECTURE

AIRCRAFT IDENTIFICATION

TITLE	PROJECT ENGINEER	SYMBOL	EXT
AIR AUGMENTED GROUND RADAR ESM DEMO	D. TAURONEY	OCTM	4433
MULTIPLE SENSOR DATA CORRELATION	W. WOLF	OCTM	4432
ADVANCED ID ASSESSMENT FOR AASR	W. WOLF	OCTM	4432
TTI SIMULATION PROGRAM UPGRADE	R. WOOD	OCTM	4434
TAC RADAR/ESM REQUIREMENTS SPECIFICATION	D. TAURONEY	OCTM	4433
MULTIPLE SENSOR FUSION TEST BED DEF.	W. WOLF	OCTM	4432
AASR REQUIREMENTS DEF.	W. WOLF	OCTM	4432
SENSOR FUSION VALIDATION	W. WOLF	OCTM	4432

MINI SESSION ON

SWITCHING

SYSTEM CONTROL

DISTRIBUTED C^3

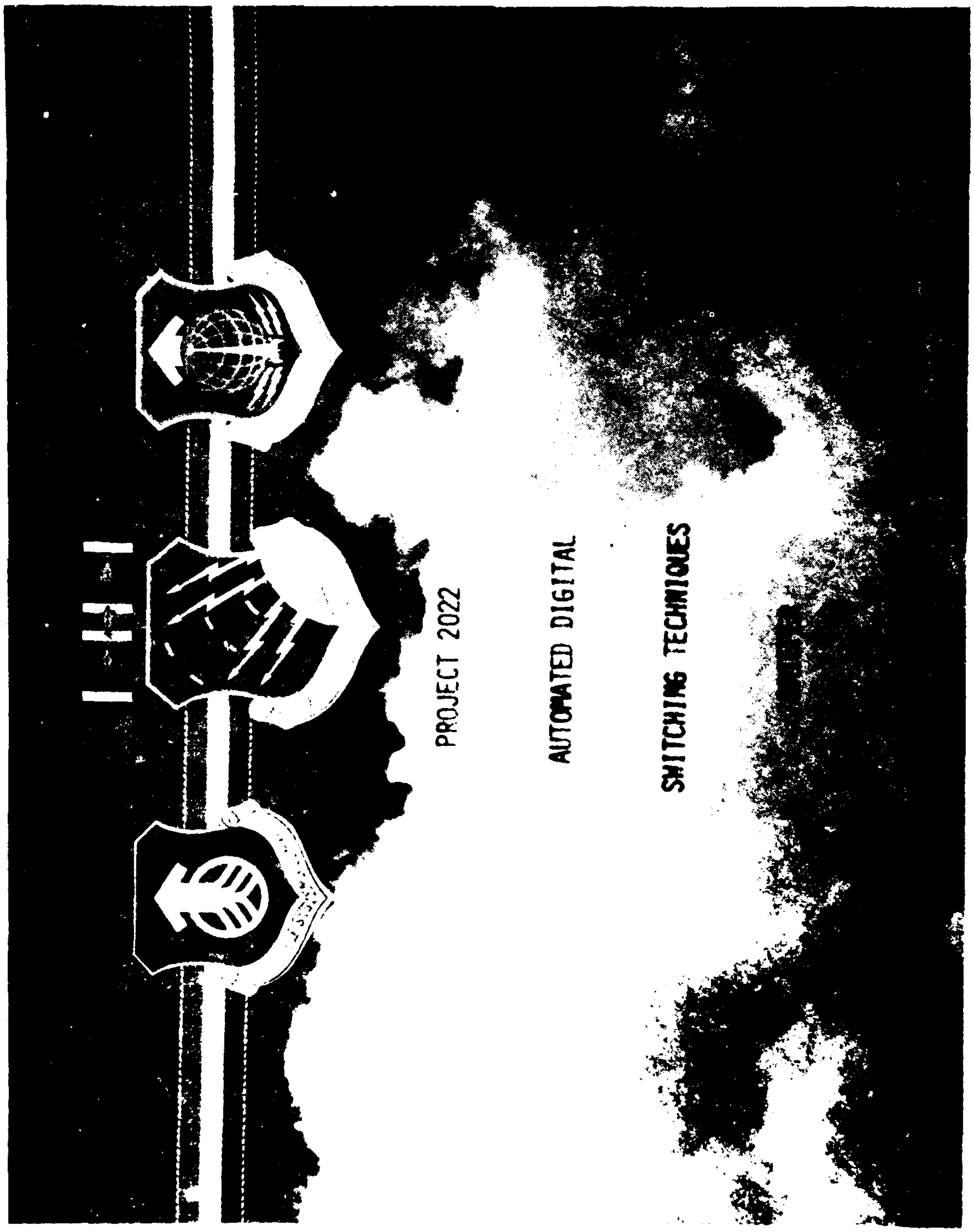
HOSTED BY: RADC/DC

BRIEFERS

SWITCHING AND ROUTING - NEIL S. MARPLES

SYSTEM CONTROL - DONALD SPECTOR

DISTRIBUTED C^3 - LT. DAVID SCHMITT


PROJECT 2022
AUTOMATED DIGITAL
SWITCHING TECHNIQUES

IPO/THRUST: 1A/SUPPORT C^3

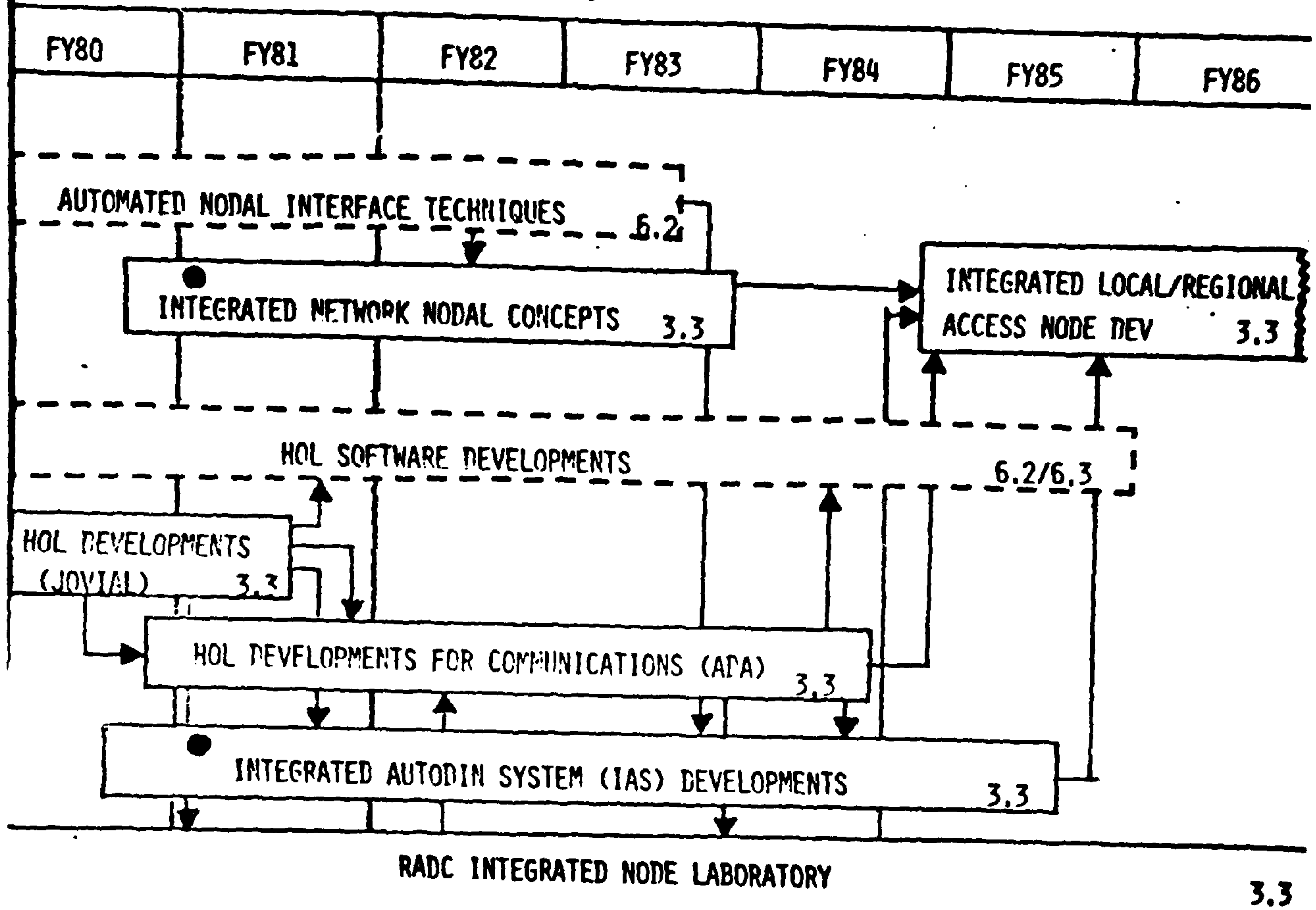
SUB-SUB-THRUST: 1A/SWITCHING AND ROUTING

PROGRAM GOALS: DEVELOP AN INTEGRATED SWITCHED SYSTEM FOR THE DEFENSE COMMUNICATIONS SYSTEM (DCS III).

TECHNICAL AREAS:
- IMPROVEMENTS/SUPPLEMENTS TO THE AUTODIN II PACKET SWITCH NETWORK
- DEVELOP AND EVALUATE ARCHITECTURAL CANDIDATES FOR POST-1990 THIRD GENERATION DEFENSE COMMUNICATION SYSTEM (DCS III).

ADC IPO/THRUST: 1A/SUPPORT C^3

UB-SUB-THRUST: 1A. SWITCHING AND ROUTING




COMMUNICATIONS SWITCH TEST FACILITY

TPO/THRUST: 1A/SUPPORT C^3

SUB-SUB-THRUST: 1.A / SWITCHING AND ROUTING

BLOCK TITLE: INTEGRATED NETWORK NODAL CONCEPTS

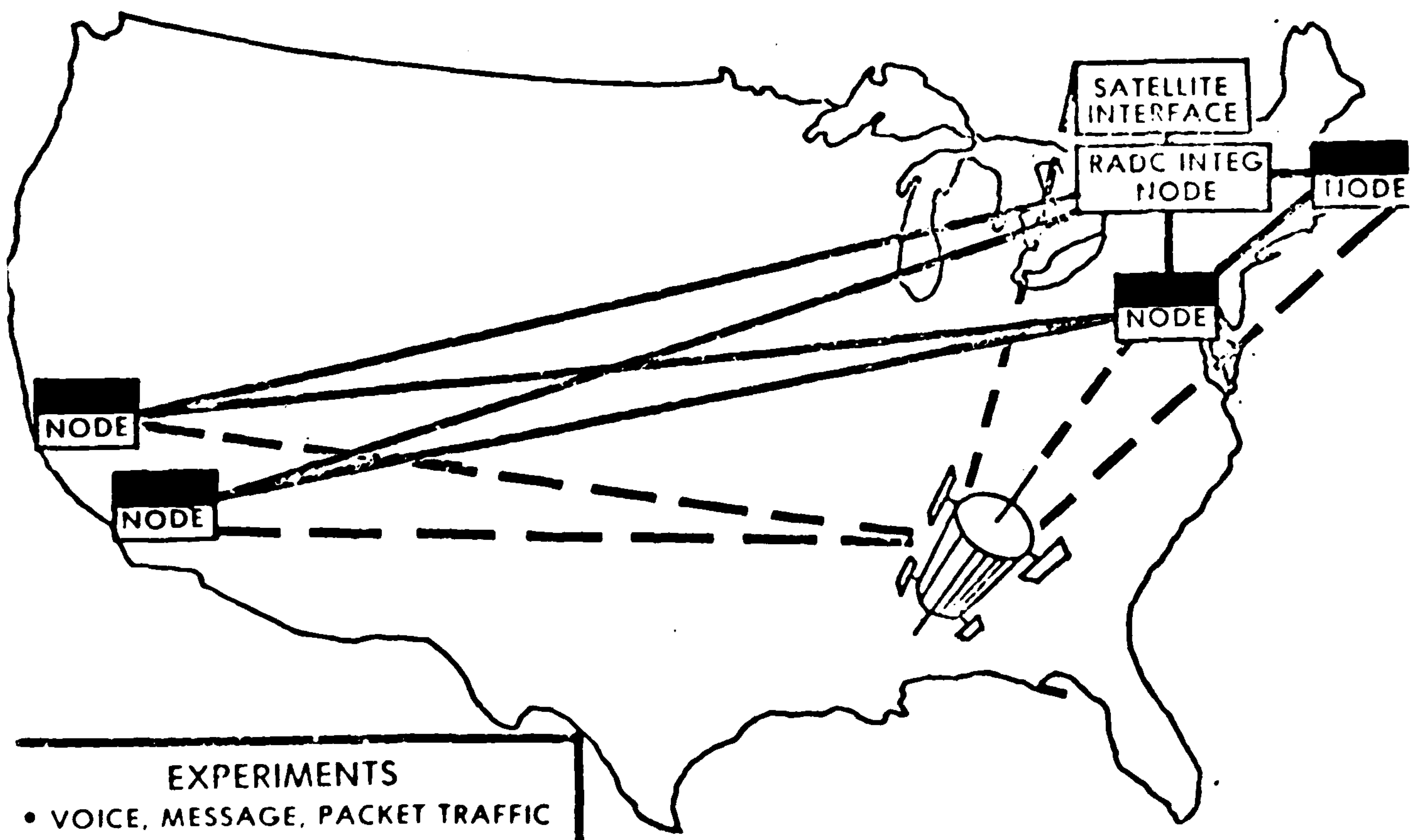
OBJECTIVE: DEVELOP AND EVALUATE CANDIDATE ARCHITECTURES FOR DCS III SWITCH

TECHNICAL APPROACH: ESTABLISH EXPERIMENTAL NETWORK UTILIZING THE RADC INTEGRATED NODE TO CONFIGURE & EVALUATE CANDIDATE ARCHITECTURES

PAYOFF: USE OF THIS EXPERIMENTAL NODAL CONFIGURATION WILL DEMONSTRATE FEASIBILITY AND REVEAL SHORTCOMINGS OF PROPOSED NODAL ARCHITECTURES

RISK: LOW. MOST SIGNIFICANT AREA OF RISK WILL BE THE GENERALIZATION OF THIS NETWORK CONFIGURATION TO THE OVERALL DCS III.

EXPERIMENTAL INTEGRATED SWITCH NETWORK (EISN)



EXPERIMENTS

- VOICE, MESSAGE, PACKET TRAFFIC
- TERRESTRIAL & SATELLITE TRUNKS
- GATHER NETWORK STATISTICS
- FORMULATE DCS III ARCHITECTURE FOR ACCESS AREA NODE

TERRESTRIAL BACKBONE

SATELLITE BACKBONE

TPO/THRUST: 1A/SUPPORT C^3

SUB-SUB-THRUST: 1.A / SWITCHING AND ROUTING

BLOCK TITLE: INTEGRATED AUTODIN SYSTEM (IAS) DEVELOPMENTS

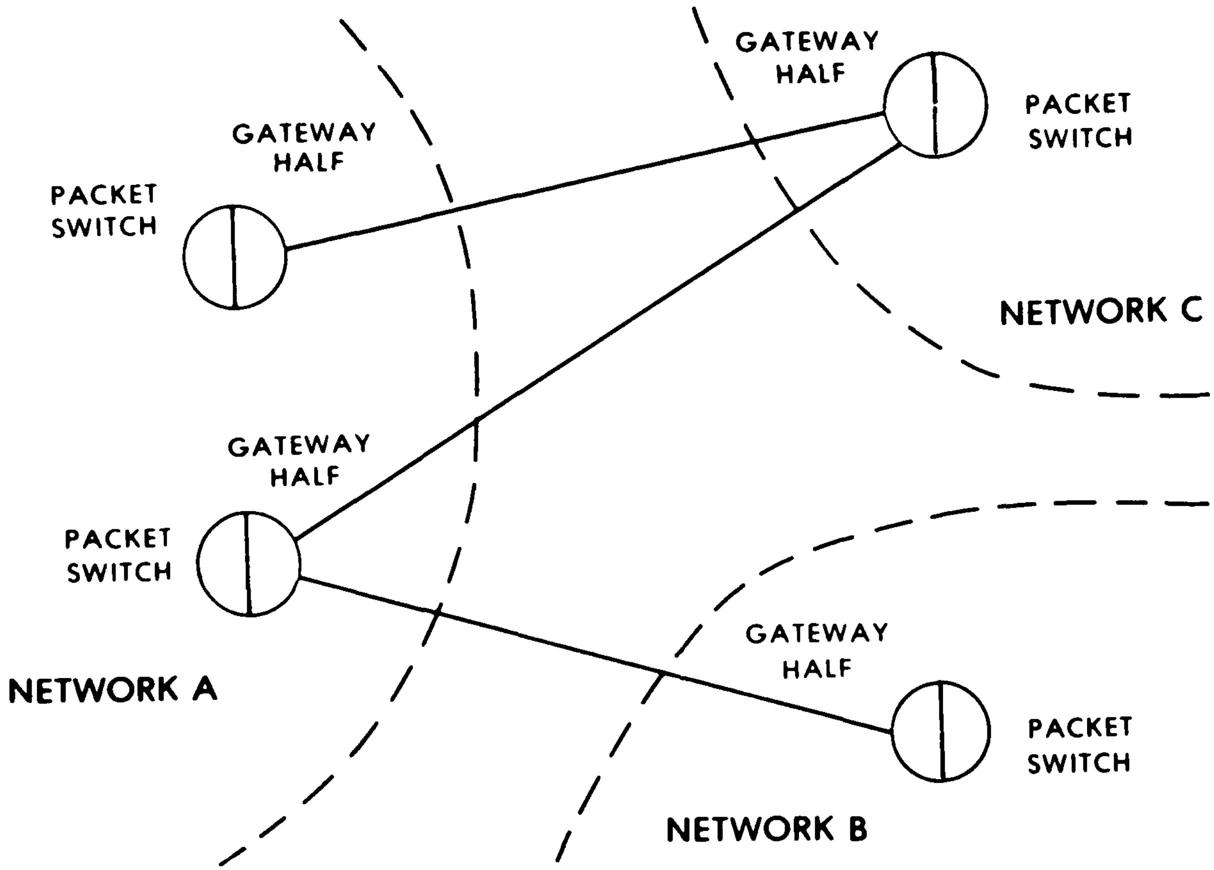
OBJECTIVE: IMPLEMENT NEW DIGITAL TELECOMMUNICATIONS SERVICES ON THE AUTODIN PACKET SWITCH NETWORK

TECHNICAL APPROACH:
- DEVELOP HARDWARE/SOFTWARE MODULES TO ACCOMMODATE NEW SERVICES
- FIELD TEST WITH A SELECT GROUP OF USERS
- GENERATE INTERFACE STANDARDS FOR FUTURE ACQUISITION

PAYOFF: COST EFFECTIVE, EFFICIENT STANDARDIZED IMPLEMENTATION OF NEW TELECOMMUNICATIONS SERVICES

RISK: LOW. TECHNOLOGY EXISTS BUT MUST BE IMPLEMENTED IN AUTODIN II

GATEWAY CONCEPT



IAS PILOT DEMONSTRATION PROGRAM

.IMPLEMENT SELECTED NEW DIGITAL TELECOMM SERVICES UTILIZING THE AUTODIN PACKET SWITCH NETWORK AS A BACKBONE

- DIGITAL FACSIMILE
- SECURE ELECTRONIC MAIL

.PROGRAM OUTPUT WILL BE A STANDARD FOR IMPLEMENTATION OF THESE NEW SERVICES FOR AUTODIN II (DOD) USERS

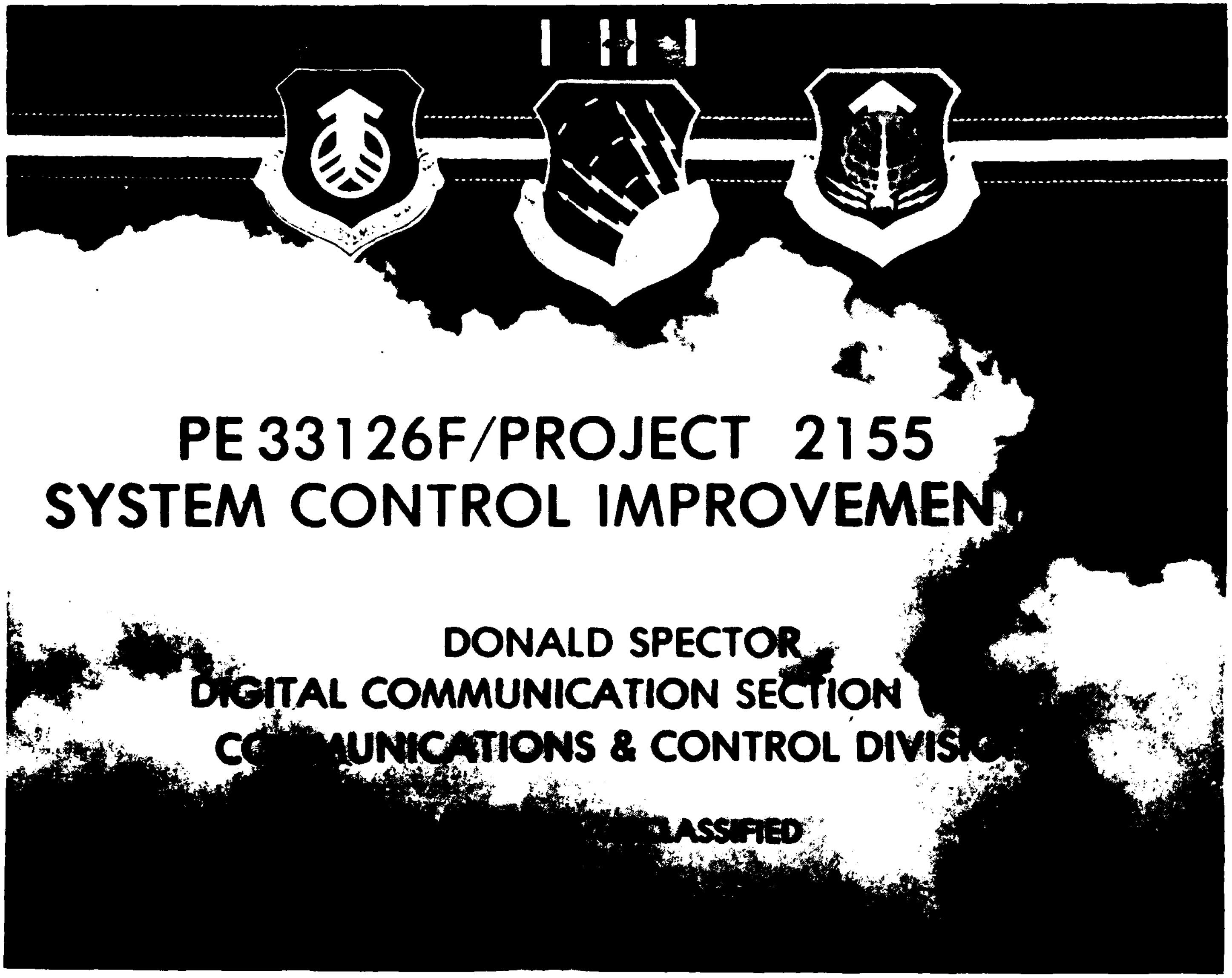
POINTS OF CONTACT

EISN - CAPT. JOSEPH DEGROAT X4567

MULTINET GATEWAY - JULIAN GITLIN X7751

PILOT DEMONSTRATIONS - NEIL S. MARPLES X7751

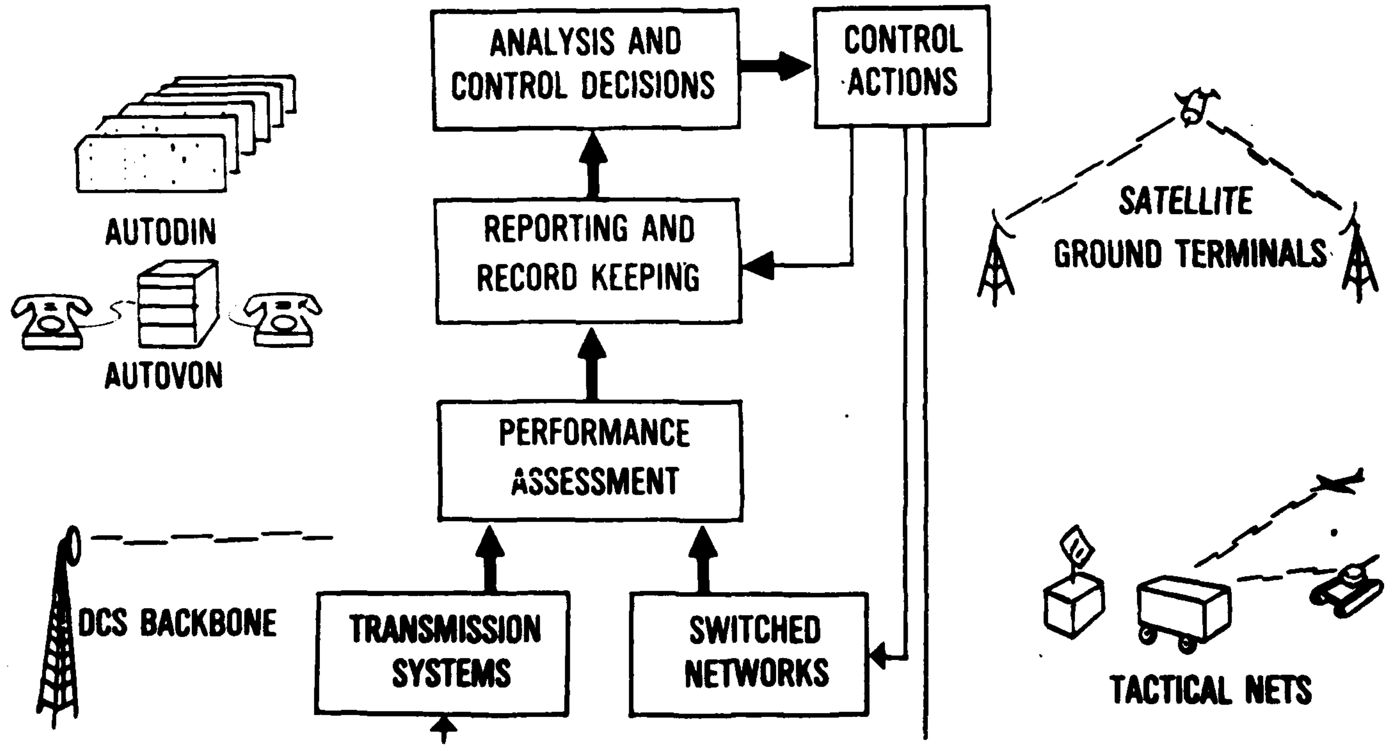
VON 587 -
COML 315-330-


PE 33126F/PROJECT 2155
SYSTEM CONTROL IMPROVEMEN
DONALD SPECTOR
DIGITAL COMMUNICATION SECTION
UNICATIONS & CONTROL DIVISI
LASSIFIED

SYSTEM CONTROL IMPROVEMENTS FOR THE DCS

ATEC

- PERFORMANCE ASSESSMENT FOR:
  - DCS DIGITAL COMM UPGRADES
  - SATELLITE TERMINALS
  - AUTOVON / AUTODIN
- COMPUTER ASSISTED NETWORK MANAGEMENT
  - TRAFFIC CONTROL
  - AUTOMATIC ROUTING / RECONFIGURATION
- DCS-TRI-TAC INTEROPERABILITY



<u>TPO/THRUST:</u> <u>1A/SUPPORT C^3</u>

<u>SUB-SUB-THRUST:</u> <u>1C/SYSTEM CONTROL</u>

<u>PROGRAM GOALS</u>: EXPAND EXISTING SYSTEM CONTROL SUBSYSTEMS TO PROVIDE:

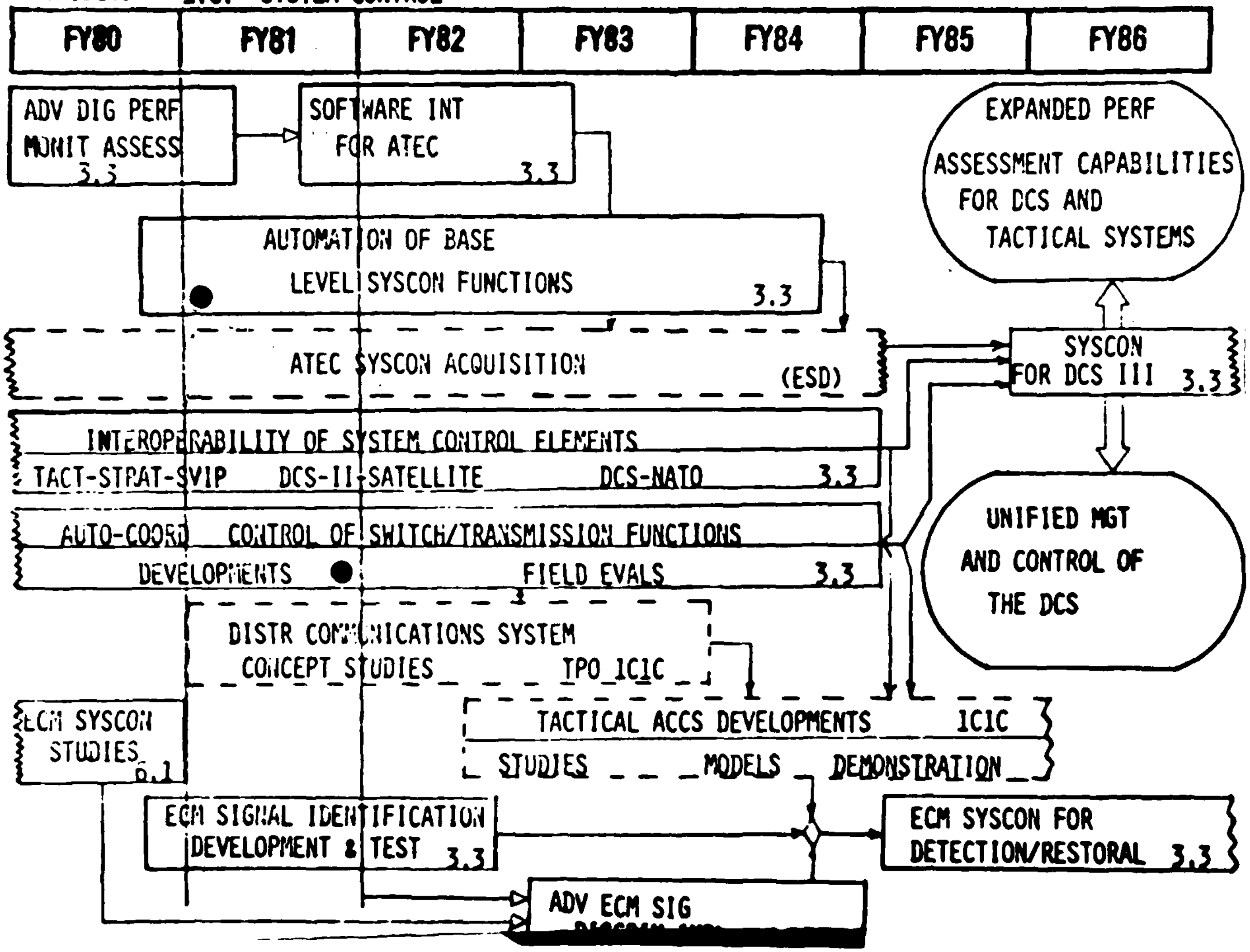
- ENHANCED PERFORMANCE ASSESSMENT
- COORDINATED RESTORAL & ALLOCATION OF NETWORK RESOURCES
- INTEROPERABILITY & SURVIVABILITY OF SYSTEM CONTROL ELEMENTS

<u>TECHNICAL AREAS:</u>

- COMM NETWORK ASSESSMENT
- ECM SIG DET, ISOLATION & CHARACTERIZATION
- CHANNEL RECONFIGURATION
- INTEROPERABILITY OF SYSTEM CONTROL ELEMENTS
- INFORMATION PROCESSING & DISPLAYS

RADC TPO I. C^3/A. SUPPORT C^3

THRUST: 1.C. SYSTEM CONTROL



TPO/THRUST: I. C^3/A. SUPPORT C^3

SUB-SUB-THRUST: 1.C. SYSTEM CONTROL

BLOCK TITLE: AUTOMATION OF BASE LEVEL SYSCON FUNCTIONS

OBJECTIVE:
- REDUCE RESPONSE & REPORTING TIME FOR RESTORAL OF SERVICE
- EXTEND ASSESSMENT/FAULT ISOLATION COVERAGE TO ADDRESS PROBLEMS BETWEEN BASE AREA & TECH CONTROL

TECHNICAL APPROACH:
- DEVELOP INTEGRATED INFO REPORTING/DISPLAY SYSTEM & MAN-MACHINE INTERFACES
- EVALUATE ALTERNATIVE MONITORING TECHNIQUES SUITABLE FOR BASE & ACCESS AREA
- DEVELOP ADV DEV MODEL OF BASE & ACCESS AREA FAULT REPORTING SYSTEM.

PAYOFF:
- GREATER NETWORK AVAILABILITY THROUGH MORE COMPREHENSIVE NETWORK PERFORMANCE VISIBILITY.
- RESOLUTION OF HIGHER PERCENTAGE OF NETWORK FAULTS.

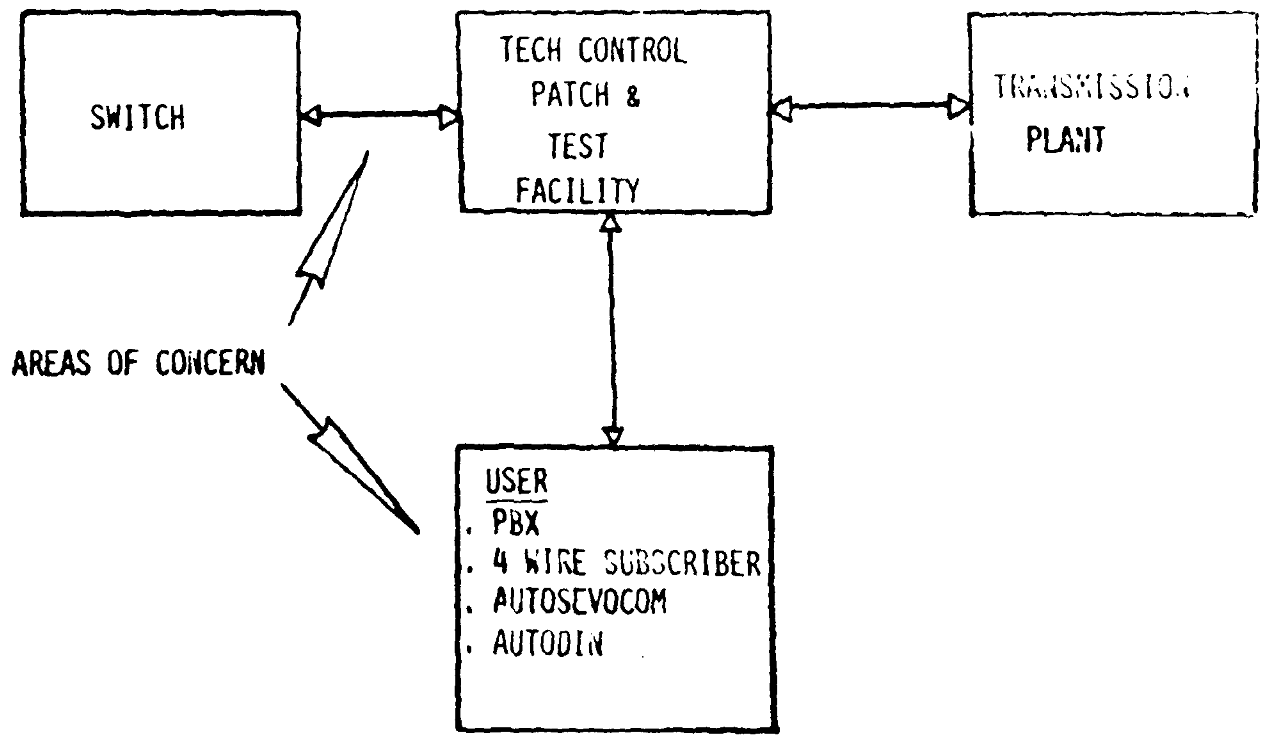
RISK: MODERATE - DISPLAYS FOR SOME SUBSYSTEMS NOT AVAILABLE

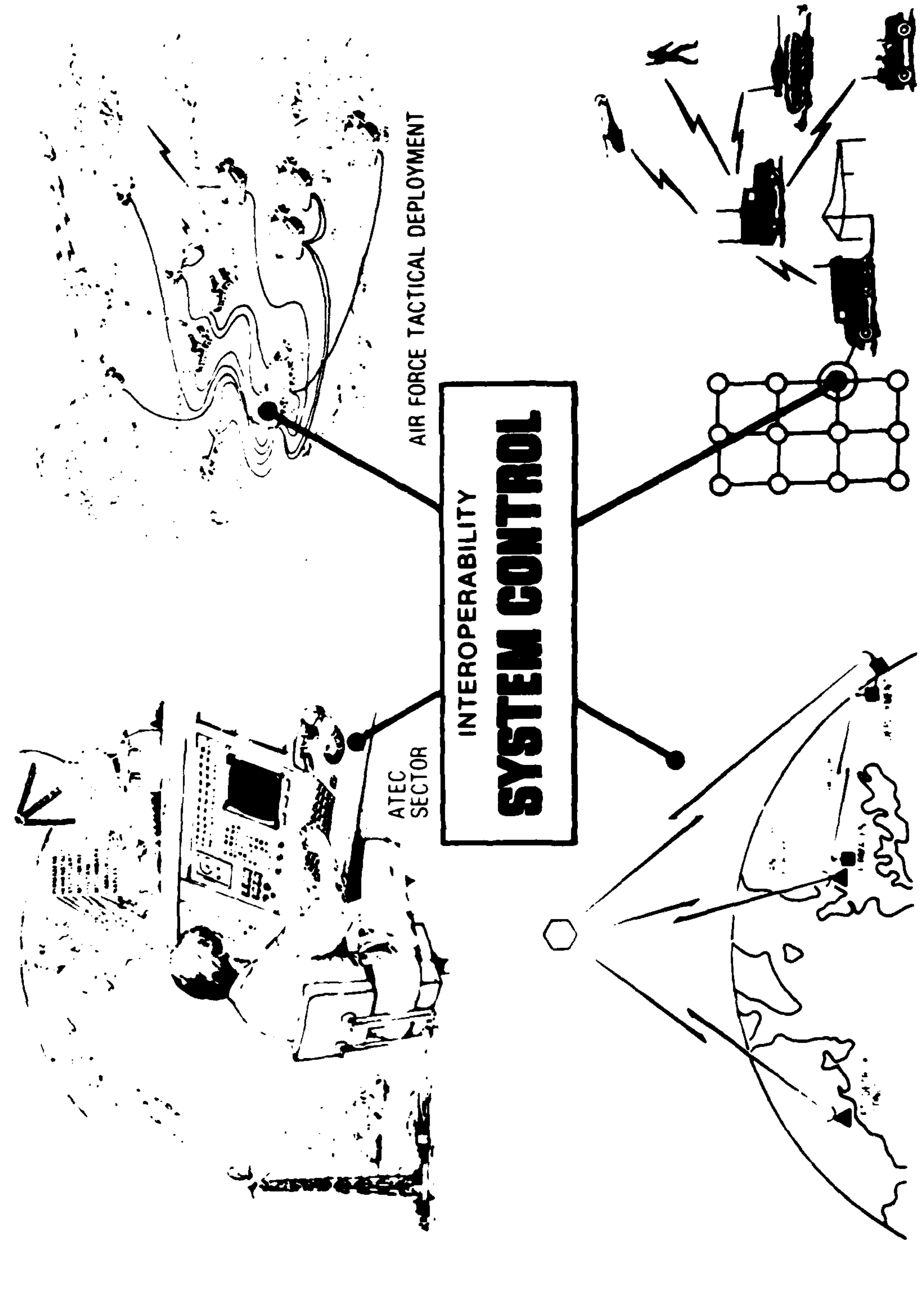
LOW - TECHNOLOGY FOR BASE LEVEL FAULT ANALYSIS EXISTS

PROBLEM IS ONE OF COST/PERFORMANCE ANALYSIS

AUTOMATED REPORTING FOR USER

AND ACCESS AREA COMMUNICATIONS




AIR FORCE TACTICAL DEPLOYMENT
ARMY CORPS
INTEROPERABILITY
SYSTEM CONTROL
ATEC
SECTOR
EXTENDED TACTICAL DEPLOYMENT

TPO/THRUST: I. C^3/A. SUPPORT C^3

SUB-SUB-THRUST: 1.C. SYSTEM CONTROL

BLOCK TITLE: AUTOMATED COORDINATION & CONTROL OF SWITCH/TRANSMISSION FUNCTIONS

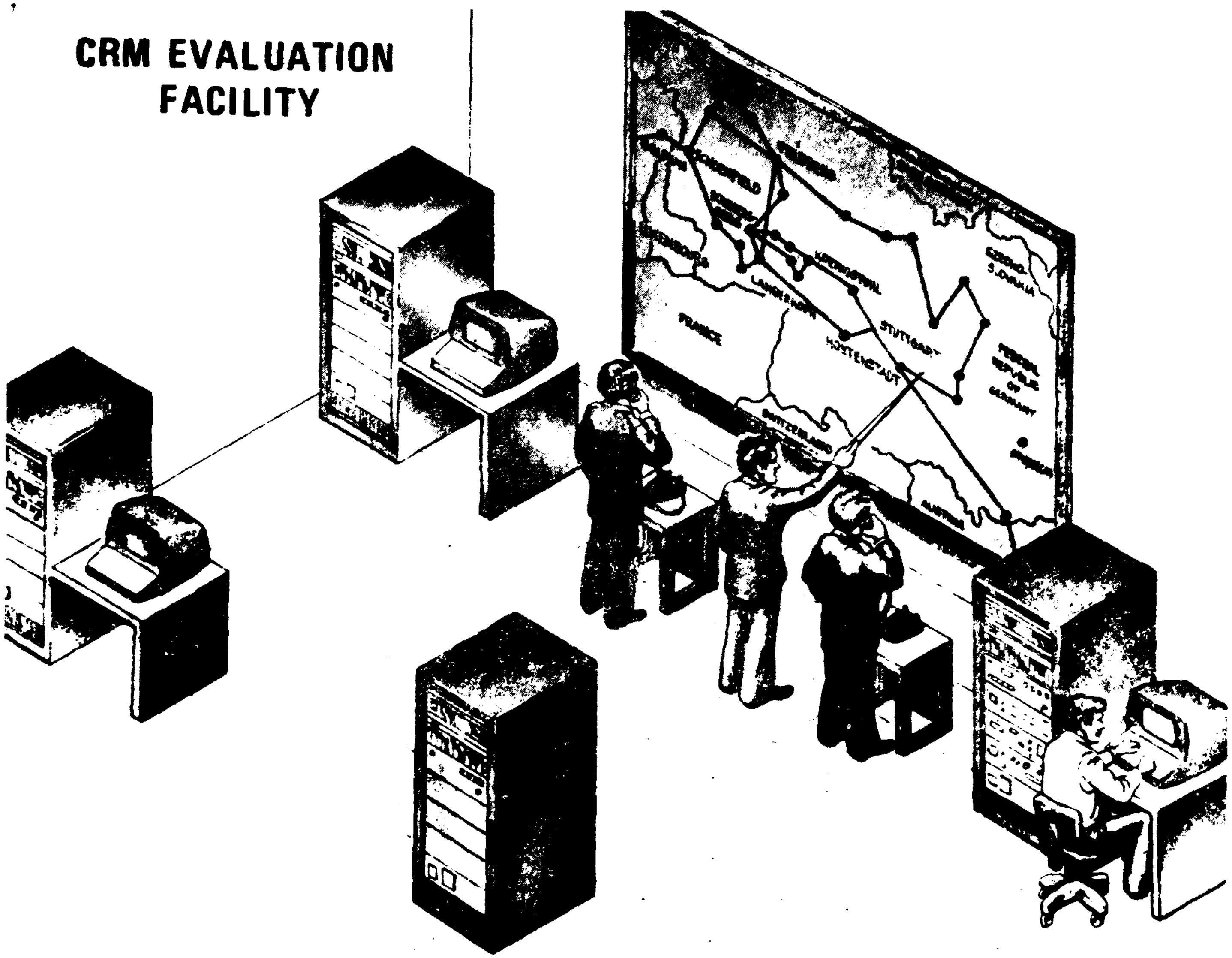
OBJECTIVE:
- DEMONSTRATE FEASIBILITY OF AUTOMATED CHANNEL RECONFIGURATION MODEL (CRM)
- DEVELOP ENHANCED, SURVIVABLE MONITORING & CONTROL CAPABILITY FOR THE OVERSEAS AUTOVON & FUTURE INTEGRATED SWITCHED NETWORKS.

TECHNICAL APPROACH:
- DESIGN, FABRICATE & TEST 3 EA CRM FEASIBILITY MODELS.
- DESIGN, FABRICATE & TEST AUTOVON NETWORK CONTROL SUBSYSTEM (ANCS)
- DEVELOP PROCEDURES & PROTOCOLS REQUIRED TO ADAPTIVELY MAINTAIN SYSTEM CONTROL IN FRAGMENTED NETWORKS.

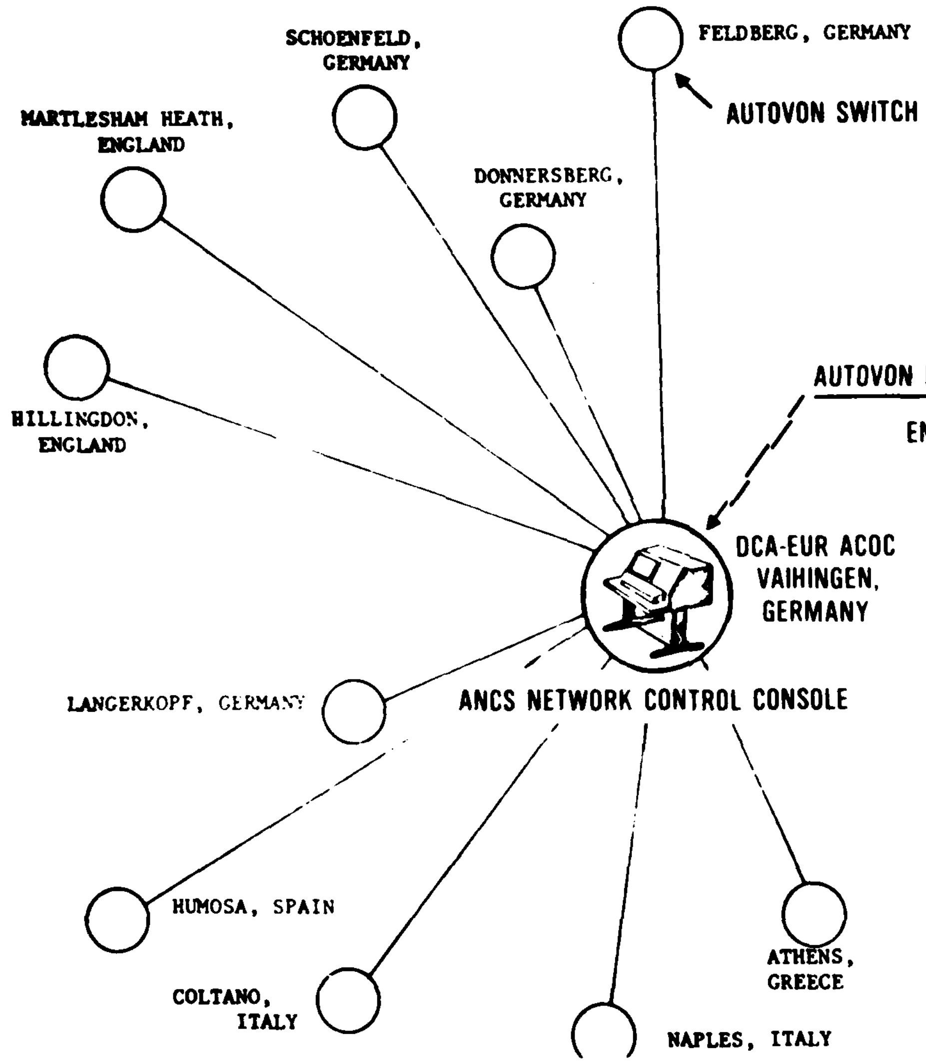
PAYOFF: IMPROVED RESTORATION, RECONFIGURATION & SURVIVABILITY OF DCS UNDER DEGRADED/CRISIS CONDITIONS.

RISK:
- CRM - MEDIUM RISK - MUST INTERFACE EXISTING & PLANNED TACTICAL & STRATEGIC SYSTEMS.
- ANCS - MODERATE RISK - SINCE SOME TECHNOLOGY AVAILABLE. MAJOR EFFORT REQUIRED TO RESOLVE MAN-MACHINE INTERFACE ISSUES.
- ADAPTIVE CONTROL - MEDIUM TO HIGH RISK - MANY UNRESOLVED ISSUES.

CRM EVALUATION FACILITY



SYSTEM CONTROL IMPROVEMENTS FOR THE OVERSEAS AUTOVON



AUTOVON NETWORK CONTROL SUBSYSTEM (ANCS

ENABLES NETWORK CONTROLLER TO:

- DISPLAY SWITCH STATUS & TRAFFIC DATA
- ASSESS NETWORK CONDITIONS
- APPLY TRAFFIC, ROUTING, & RESTORATION CONTROLS

TECHNOLOGY - INTENSIVE SYSCON DEVELOPMENTS

MAJOR AREAS OF INTEREST	TECHNOLOGY AREAS
DIGITAL PERFORMANCE MONITORING & ASSESSMENT	. RADIO LINK MONITORS . SYSTEM FAULT ISOLATION ALGORITHMS . TRENDING ALGORITHMS
AUTOMATION OF BASE LEVEL FUNCTIONS	. CORRELATION OF SWITCH & TRANS FUNCTIONS . DISPLAYS FOR CONTROL OF NODAL SUBSYSTEMS . LOW COST FACILITY STATUS MONITORS
INTEROPERABILITY OF SYSTEM CONTROL ELEMENTS	. DEVELOPMENT OF PROTOCOL & DISPLAYS FOR INTERSYSTEM MONITORING, COORDINATION, & CONTROL OF MAJOR AF SYSTEMS.
AUTOMATED COORDINATION & CONTROL OF SWITCH/TRANSMISSION FUNCTIONS	. DEVELOPMENT OF STATUS DISPLAYS, NETWORK CONTROLS, TRAFFIC ANALYSIS CAPABILITIES . AUTOMATED DIGITAL PATCHING & NETWORK ALGORITHMS . ELECTRONIC SURVIVABILITY
ECM SIGNAL IDENTIFICATION DEVELOPMENT & TEST	. PATTERN ANALYSIS . TIME/FREQUENCY/AMPLITUDE CHARACTERIZATION TECHNIQUES

POINTS OF CONTACT

SYSTEM CONTROL

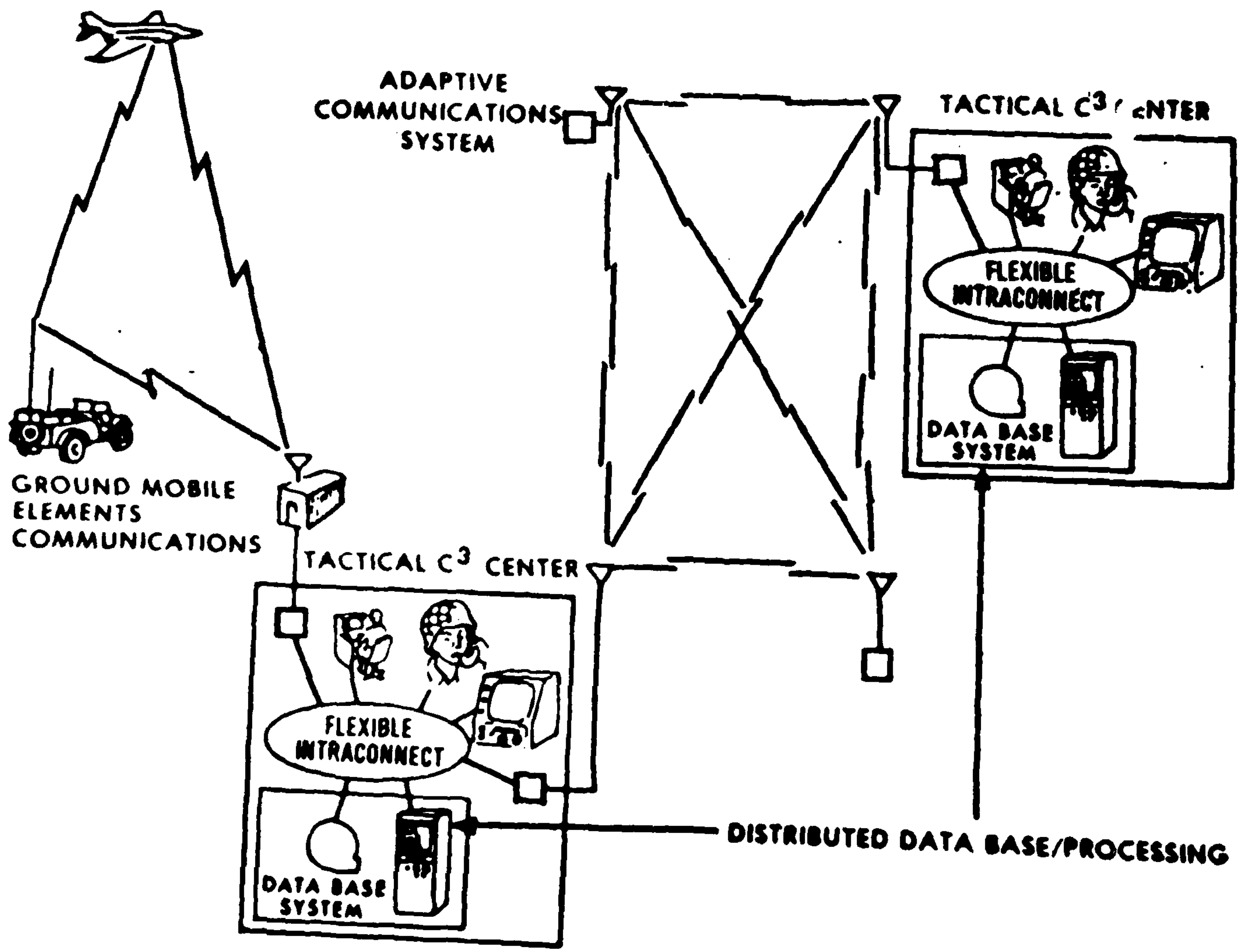
PROGRAM TITLE	COGNIZANT ENG	TELEPHONE
AUTOMATED REPORTING FOR USER & ACCESS AREA COMM	MR. CHARLES MEYER/DCLD	330-4374
ADAPTIVE CONTROL FOR INTEGRATED NETWORKS	MR. DONALD SPECTOR/DCLD	330-4374

TACTICAL DISTRIBUTED C^3

PRESENTED BY

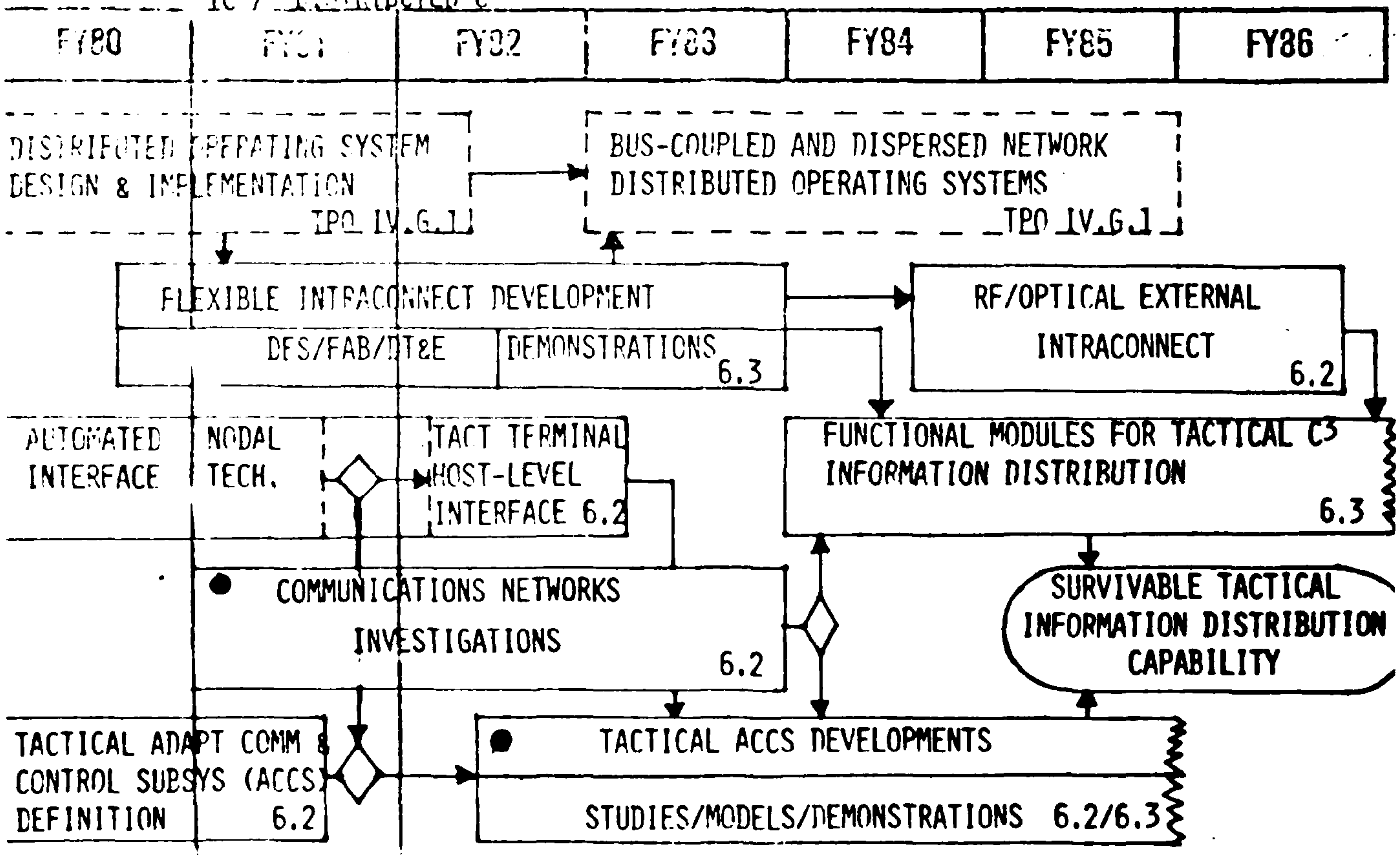
LT DAVID SCHMITT

DISTRIBUTED C³



RADC TPO 1C/TACTICAL C^3

THRUST: 1C / DISTRIBUTED C^3



TPO/THRUST: I. C^3/C. TACTICAL C^3

SUB-SUB-THRUST: I.C. DISTRIBUTED C^3

BLOCK TITLE: TACTICAL ACCS DEVELOPMENTS

OBJECTIVE: DEVELOP AN ADAPTIVE COMMUNICATIONS AND CONTROL SUBSYSTEM TO PROVIDE SURVIVABLE, MOBILE GROUND/GROUND COMMUNICATIONS FOR THE TACTICAL AIR FORCES (TAF) FOR POST 1985

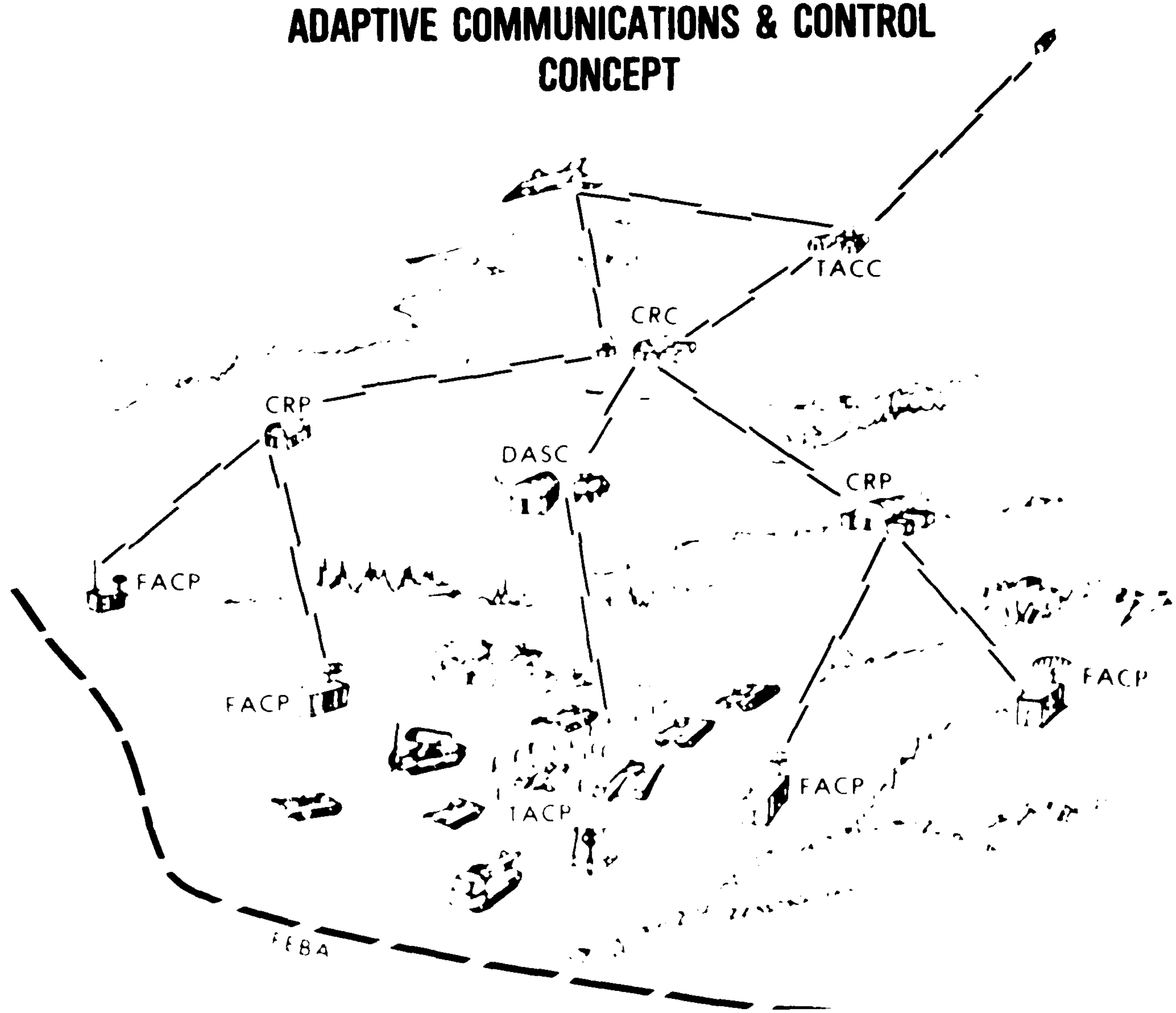
TECHNICAL APPROACH:

- EVALLATE SUBSYSTEM ALTERNATIVES RESPONSIVE TO TAFIIS
- DEVELOP ADVANCED TACTICAL COMM TRANSMISSION, SYSTEM CONTROL AND COMM PROCESSING ELEMENTS
- INTEGRATE ELEMENTS INTO SYSTEM ARCHITECUTRE

PAY OFF: ROBUST, HIGHLY MOBILE, SURVIVABLE GROUND/GROUND COMMUNICATIONS

RISK: MODERATE - DETAILED DEFINITION AND MODELING REDUCE RISK

ADAPTIVE COMMUNICATIONS & CONTROL CONCEPT



TPO/THRUST: 1C/TACTICAL C^3

SUB-SUB-THRUST: 1C/DISTRIBUTED C^3

BLOCK TITLE: COMMUNICATIONS NETWORKS INVESTIGATIONS

OBJECTIVE: DEVELOP ADAPTIVE COMMUNICATIONS CONTROL AND DISTRIBUTION TECHNIQUES FOR INTELLIGENCE DATA DISTRIBUTION AND LOCAL AREA APPLICATIONS.

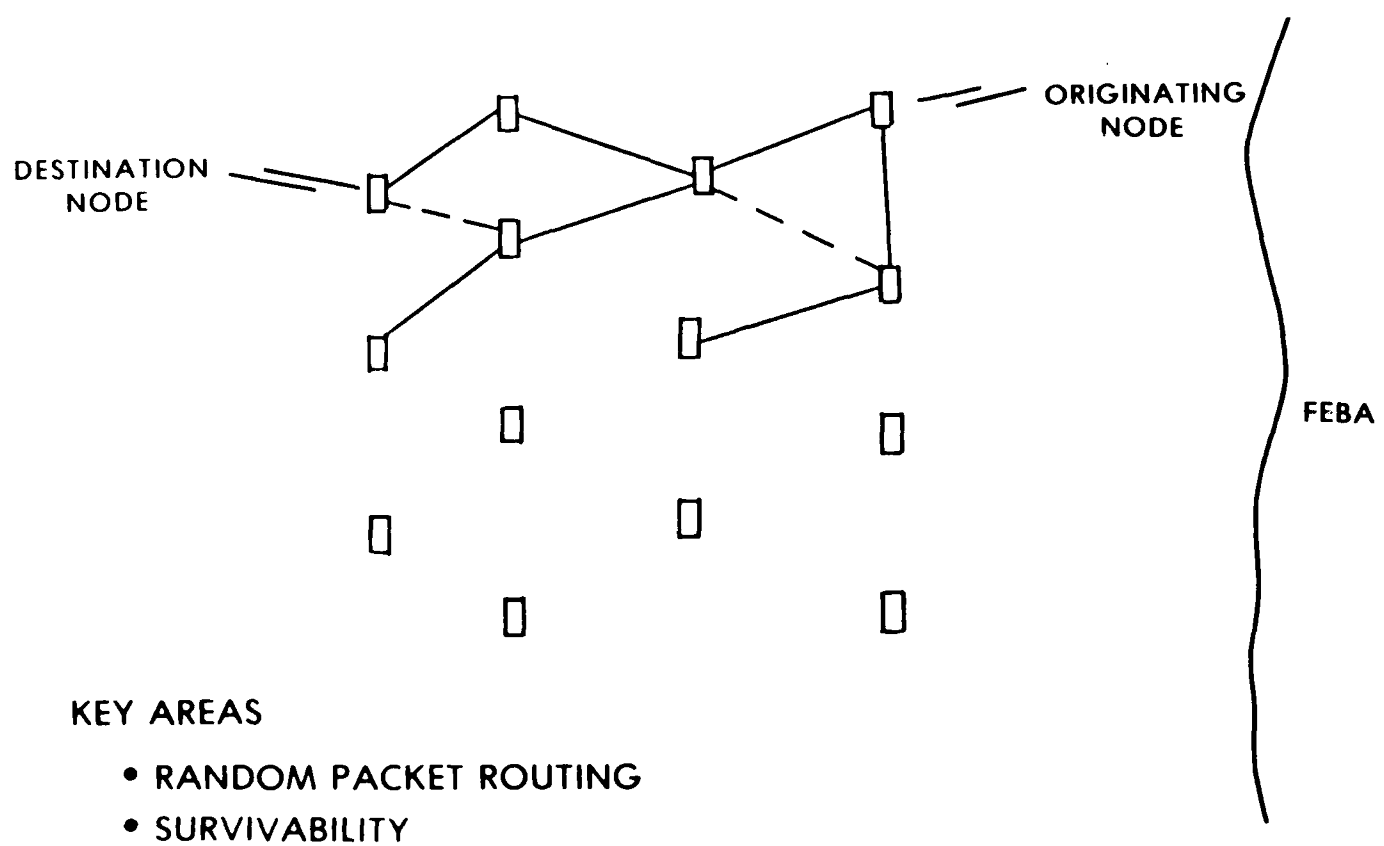
TECHNICAL APPROACH: STUDY/ANALYZE/DEVELOP PROCESSOR CONTROLLED ADAPTIVE DATA ROUTING AND SYSTEM CONTROL:

- INTELLIGENCE ANALYST
- TACTICAL FORWARD AREA PACKET COMM

PAY OFF: HIGHLY SURVIVABLE COMM DISTRIBUTION FOR INTELLIGENCE AND FORWARD AREA APPLICATIONS.

RISK: LOW - INTELLIGENCE ANALYST
MODERATE - PACKET COMMUNICATION

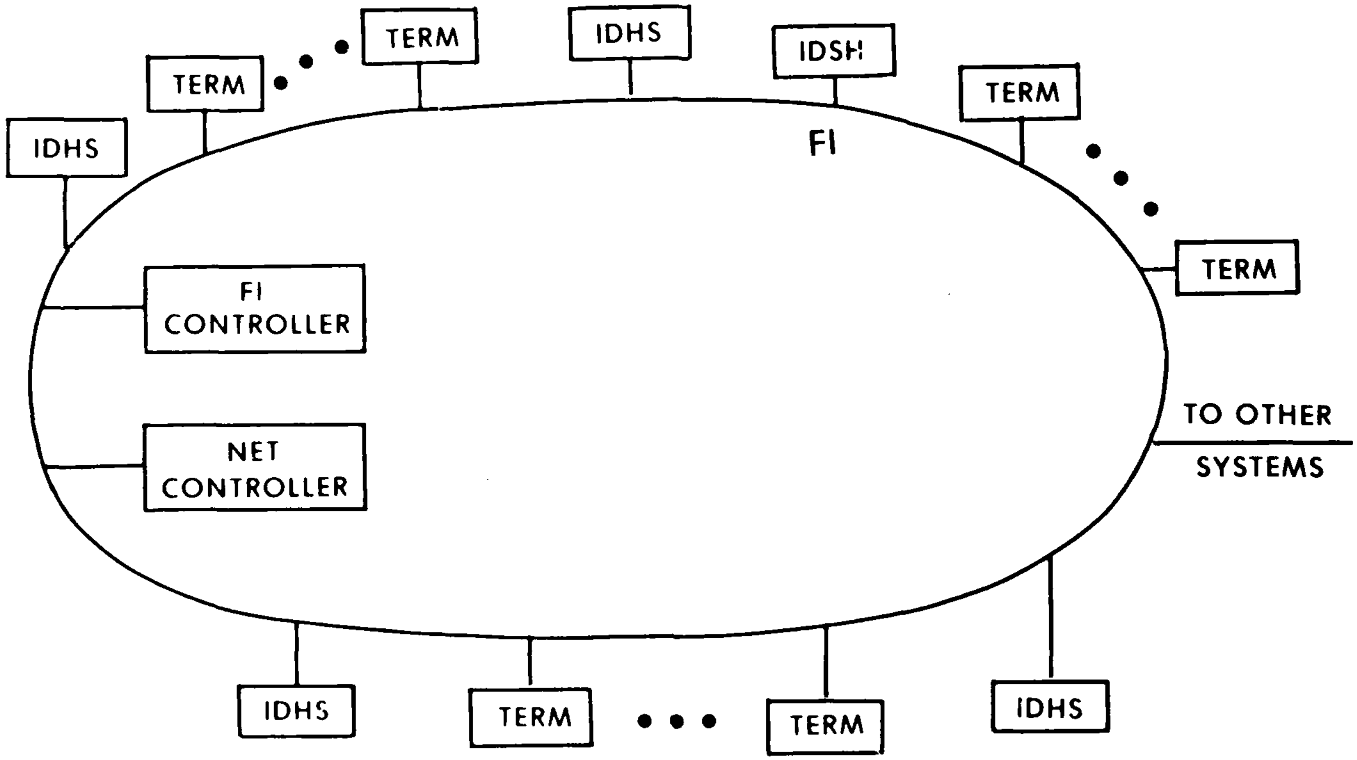
PACKET RADIO NETWORK



KEY AREAS

- RANDOM PACKET ROUTING
- SURVIVABILITY

INTELLIGENCE COMMUNICATIONS DISTRIBUTION SYSTEM (ICDS)



FI · FLEXIBLE INTRACONNECT

IDHS · INTELLIGENCE DATA HANDLING SYSTEMS

TERM TERMINALS

CONTACT POINTS

INTELLIGENCE COMMUNICATIONS DISTRIBUTION SYSTEM - - - LT DAVID R. SCHMITT
DCLF/X4567

PACKET RADIO NETWORK - - - - - - - - - - - - - - - - - - MR DANIEL McAULIFFE
DCLF/X4567

TACTICAL ACCS DEVELOPMENTS - - - - - - - - - - - - - - - CAPT EMANUEL R. SIVE
DCLF/X4567

ANTENNAS

JOHN McILVENNA

ELECTROMAGNETIC SCIENCES DIVISION

RADC/EE

HANSCOM AFB, MA 01731

TPO/THRUST: 4C ELECTROMAGNETICS

SUB/THRUST: 1 ANTENNAS

PROGRAM GOALS:

- DEVELOP ADVANCED ANTENNA TECHNOLOGY FOR GROUND BASED, SPACE BASED AND AIRCRAFT APPLICATIONS

PROGRAMS: 6.1, 6.2, 6.3

FRACTION OF TOTAL EFFORT: 1/3, 2/3, SMALL BUT GROWING

TECHNICAL AREAS:

- ARRAY AND REFLECTOR STUDIES — 6.1, 6.2
- DETERMINISTIC AND ADAPTIVE RADIATION PATTERN CONTROL — 6.1, 6.2
- LOW PROFILE AND CONFORMAL AIRCRAFT ANTENNAS 6.1, 6.2, 6.3
- LONG WAVE ANTENNAS

6.1 TASK AREAS

PHASED ARRAY ANTENNAS

CONFORMAL ANTENNAS

REFLECTOR/APERTURE ANTENNAS

13 WORK UNITS,
- 4 IN-HOUSE
- 9 UNIVERSITY CONTRACT

6.1 EFFORTS

PHASED ARRAY ANTENNAS

- ARRAY TECHNIQUES
  - WIDEBAND, WIDE-ANGLE SCAN
    - OVERLAPPED SUBARRAYS
    - MICROWAVE LENS
  - LIGHTWEIGHT ARRAY ELEMENTS
    - METAL FILM DIPOLES
- NONUNIFORM GROUND SYSTEMS FOR HF ARRAYS
  - THEORY FOR ARBITRARY VERTICAL ARRAYS
- RADIATING ELEMENTS FOR MILLIMETER REGION
  - ELEMENTS COMPATIBLE WITH VARIOUS LOW-LOSS, HIGH POWER TRANSMISSION LINE FEEDS

6.1 EFFORTS

CONFORMAL ANTENNAS

- MICROSTRIP ANTENNAS
  - BASIC RADIATION MECHANISM FOR VARIOUS CANONICAL SHAPES
  - OPTICAL DESIGN METHODS FOR MILLIMETER WAVES
  - MULTIPLE FREQUENCY OPERATION VIA MULTIPLE FEED POINTS
  - ELEMENTS OF ARBITRARY SHAPE VIA SURFACE PATCH METHOD
- SLOTTED WAVEGUIDE ARRAYS
  - MUTUAL COUPLING/FEED STRUCTURE

6.1 EFFORTS

REFLECTOR/APERTURE ANTENNAS

- LARGE SATELLITE ANTENNAS WITH LOW SIDELOBES
  - CLUSTER OFFSET FEEDS, REFLECTOR/LENS SURFACE SHAPING, FRESNEL-ZONE CALCULATIONS
- SURFACE-PATCH MODELING FOR RADIATION/SCATTERING
  - ANALYSIS FOR CONDUCTORS OF ARBITRARY SHAPE

BLOCK TITLE: VLF ANTENNA STUDIES

OBJECTIVE: FURNISH AF C3 MISSION WITH NEW ANTENNA TECHNOLOGY FOR VLF EMERGENCY COMMUNICATIONS/JAM RESISTANT COMMUNICATION MODES

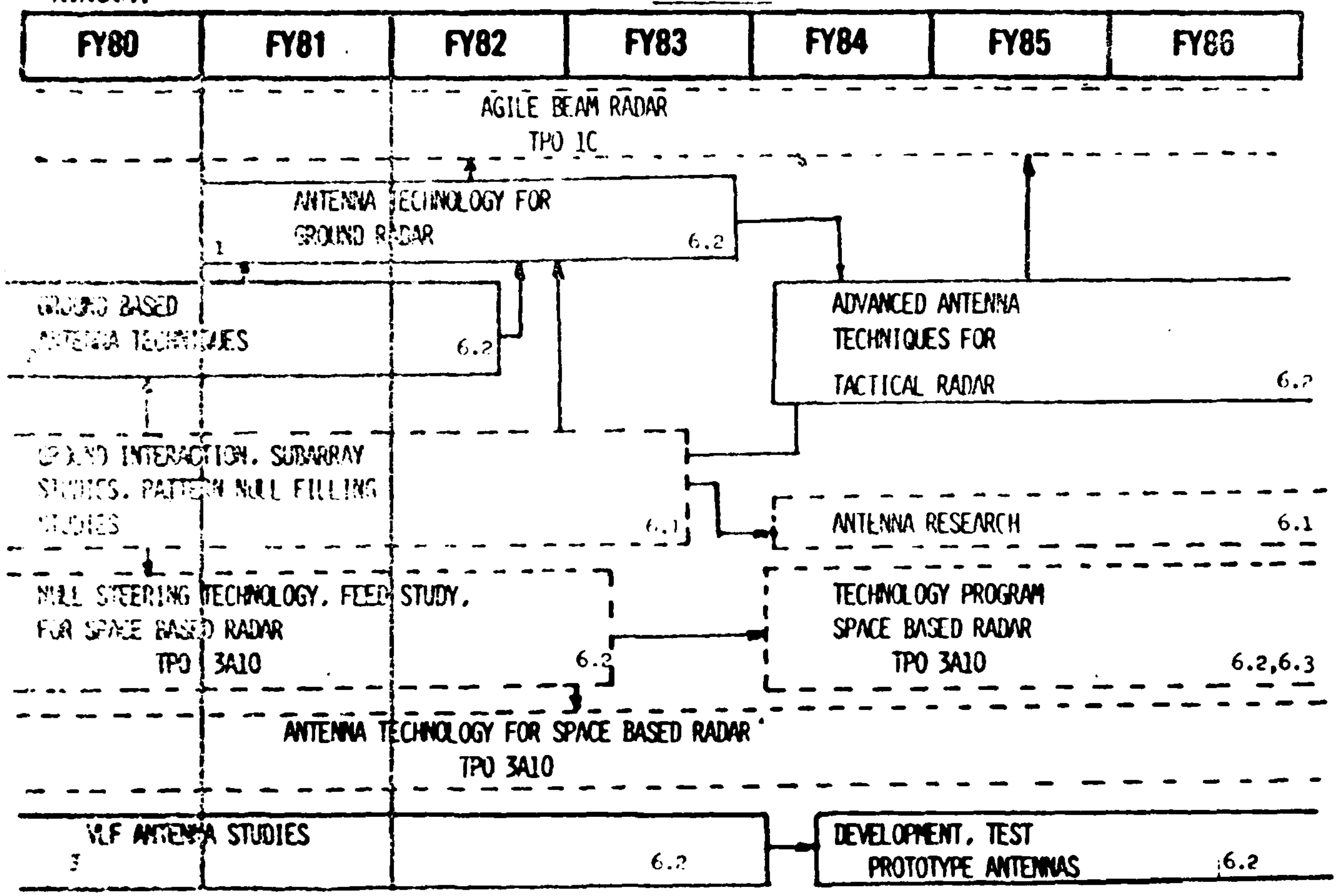
TECHNICAL APPROACH: EXAMINE RADIATION AND EFFICIENCY OF VLF LOOP AND GROUND BASED TE ANTENNAS. ANALYZE DISPERSIBLE ANTENNA AND POTENTIAL SUB-CUTOFF FREQUENCY ANTENNAS

PAY OFF: EXTENSION OF VLF COMMUNICATIONS RANGE, RELIABILITY, AND SURVIVABILITY

RADC TPO 4. TECHNOLOGY

THRUST: 4C ELECTROMAGNETICS

SUB-THRUST: 4C10 ANTENNAS (ANTENNA PATTERN CONTROL)



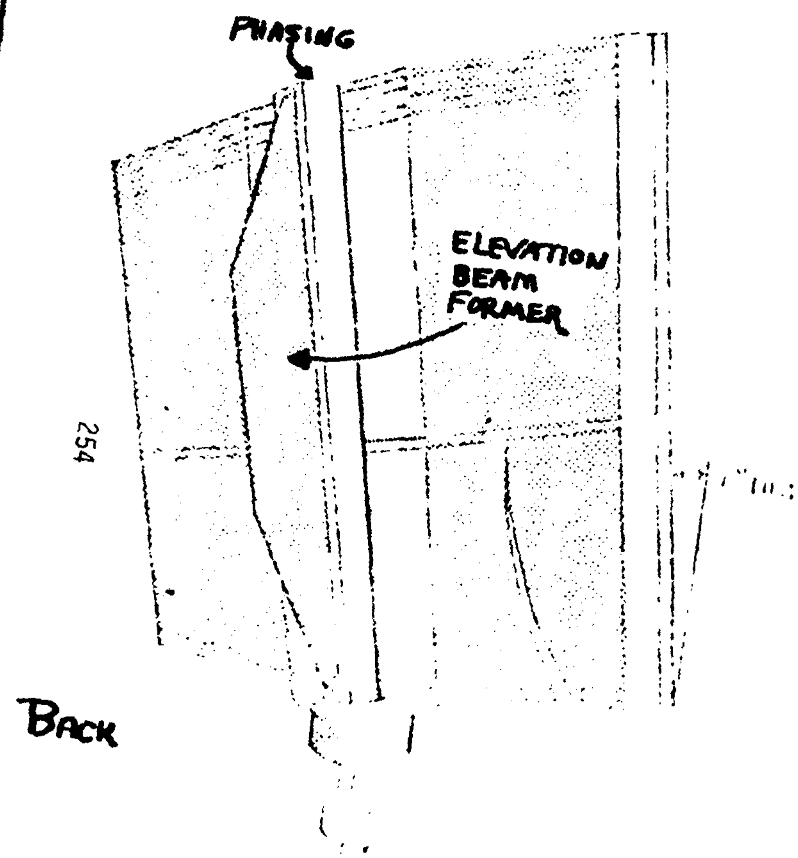
EFFORT BLOCK TITLE: GROUND BASED ANTENNA TECHNIQUES

OBJECTIVE: DEVELOP NEW ANTENNA TECHNOLOGY FOR GROUND BASED RADAR

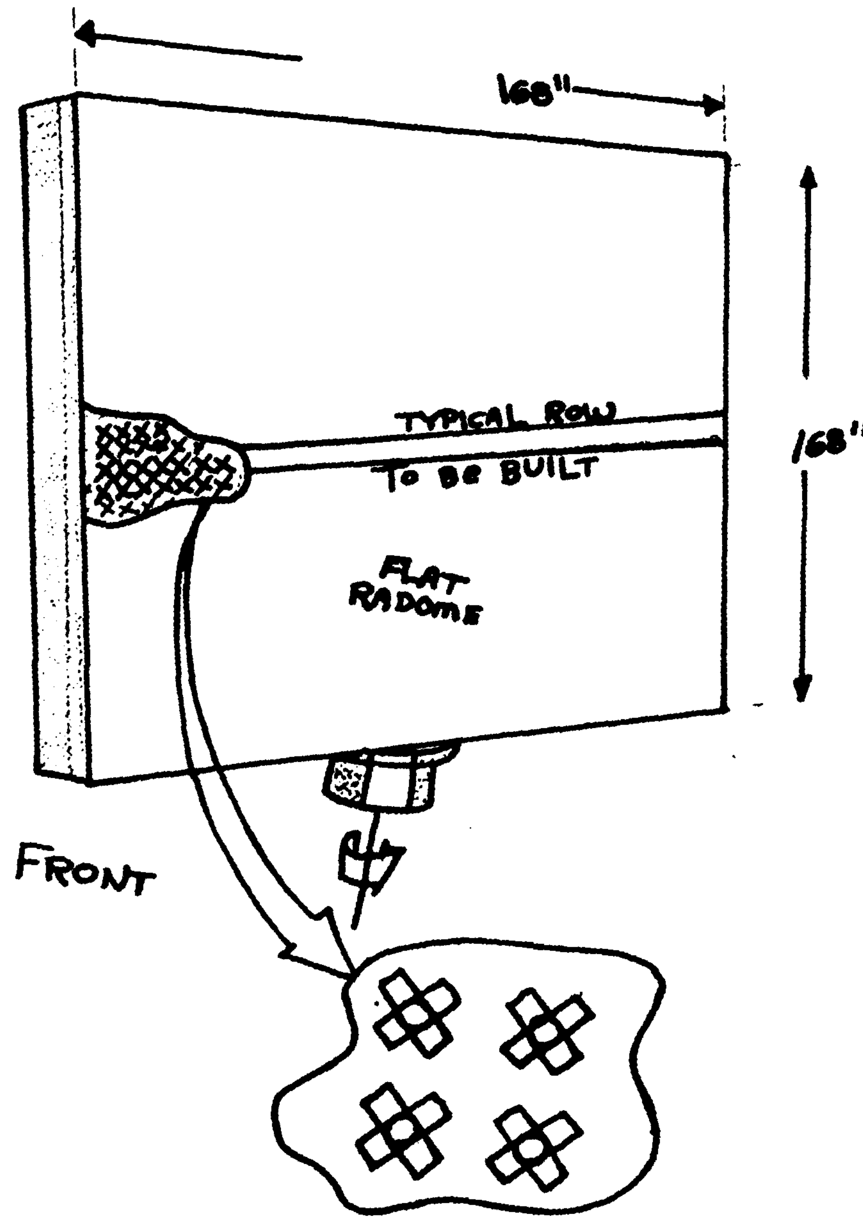
TECHNICAL APPROACH:

- DIGITAL BEAM STEERING
- ANGULAR FILTER
- LOW SIDELOBE LINE SOURCE FEED
- LOW SIDELOBE PARABOLIC CYLINDER ANTENNA
- CIRCULAR ARRAY DESIGNS
- WIDEBAND LENS AND SUBARRAY STUDIES

PAYOFF: LOW SIDELOBE ANTENNAS FOR GROUND RADAR

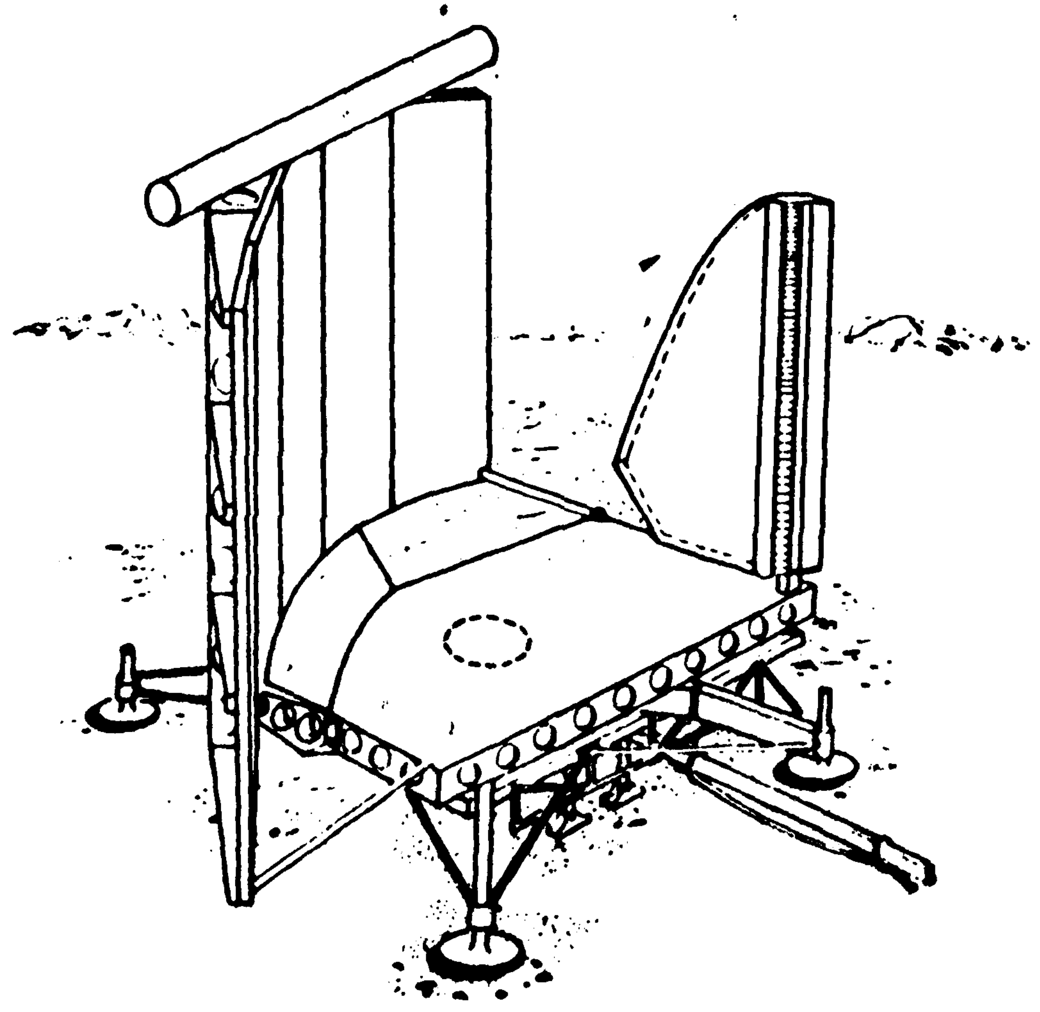


PHASING
ELEVATION
BEAM
FORMER
BACK

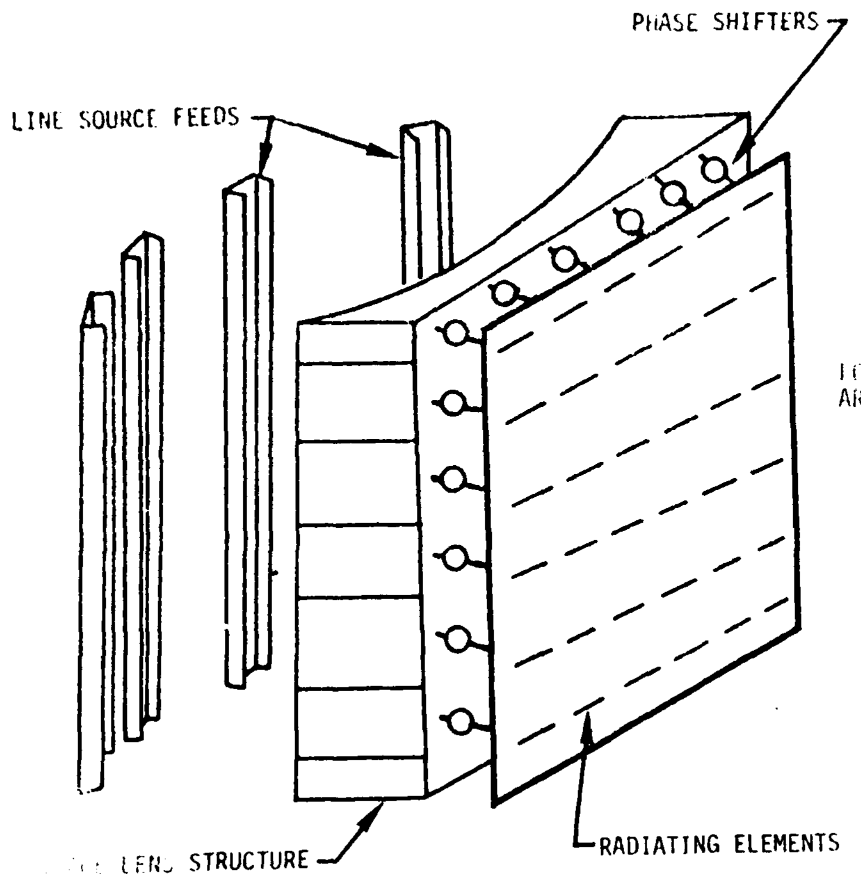


168"
168"
TYPICAL ROW
TO BE BUILT
FLAT
RADOME
FRONT

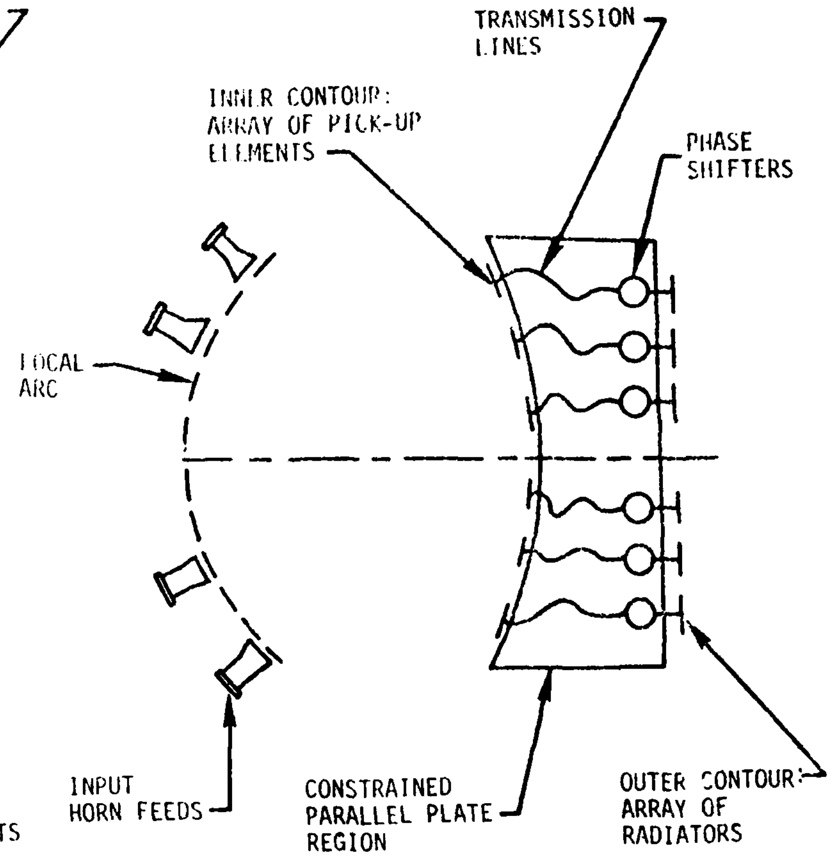
PARABOLIC CYLINDER



3D CYLINDRICAL CONSTRAINED LENS



A) 3D MODEL



B) 2D COUNTERPART

DIGITAL BEAM STEERING

- DIGITAL TECHNIQUES FOR ALL PHASED ARRAY BEAM FUNCTIONS.
  - STEERING
  - NULLING - MAINBEAM AND SIDELOBES
  - SIDELOBE CONTROL
  - TIME VARYING APERTURE WEIGHTING
- STUDY AND EXPERIMENT
- EVALUATE BANDWIDTH AND PROCESSING TIME CONSTRAINTS
- COST AND PRACTICALITY

FY 81 STARTS

EFFORT BLOCK TITLE: ANTENNA TECHNOLOGY FOR GROUND RADAR

OBJECTIVE: DEVELOP NEW ANTENNA TECHNOLOGY WITH IMPROVED ECCM FEATURES FOR GROUND BASED RADAR

TECHNICAL APPROACH:

- CONSTRAINED FEED SUBARRAY
- DUAL BAND ARRAY FOR TAC RADAR
- ADAPTIVE SPACE FED ANTENNA SYSTEM

PAYOFF: ANTENNA TECHNIQUES FOR RADAR SYSTEMS

LOW COST, HIGH PERFORMANCE RADAR SYSTEMS

TITLE: CONSTRAINED FEED OVERLAPPED SUBARRAY ANTENNA

OBJECTIVE: DEVELOP COMPACT BROADRAND SCANNING ARRAY ANTENNAS WITH SIDELOBE AND MAINLOBE NULLING AS ECCM FEATURES.

APPROACH:

- INVESTIGATE CONSTRAINED FEED-OVERLAPPED SUBARRAY TECHNIQUES TO COMPLEMENT EFFORTS IN SPACE-FED-OVERLAPPED SUBARRAYS.
- DESIGN APPROPRIATE COMBINATIONS OF ORTHOGONAL LENS BEAMFORMERS, BUTLER MATRICES OR SWITCHING NETWORKS TO PRODUCE PRACTICAL OVERLAPPED SUBARRAYS
- CONSTRUCT AND TEST A PART OF SUCH AN ARRAY DESIGN

PROPOSED EFFORT: OPEN-BID, 2 YRS, FY 81 - FY 83, ABOUT 3 MY

TITLE: ADAPTIVE SPACE-FED OVERLAPPED SUBARRAY ANTENNA

OBJECTIVE: STUDY CAPABILITIES OF SPACE-FED OVERLAPPED SUBARRAYS TO PERFORM SIDELOBE AND MAIN BEAM NULLING.

APPROACH:

- INVESTIGATE COST EFFECTIVENESS OF NULL PLACEMENT AT ARRAY FACE AND AT FEED.
- COMPUTER STUDY OF TRADEOFFS IN SIDELOBE LEVEL, BAND OF OPERATION, ADAPTIVE NULL DEPTH AND WIDTH, NUMBER AND BANDWIDTH OF NULLS.
- STUDY PROCESSING NEEDED TO COUNTER 1 TO 10 JAMMERS OVER 15% BANDWIDTH.

PROPOSED EFFORT: OPEN-BID, 2 YRS, FY 81 - FY 83, ABOUT 3 MY

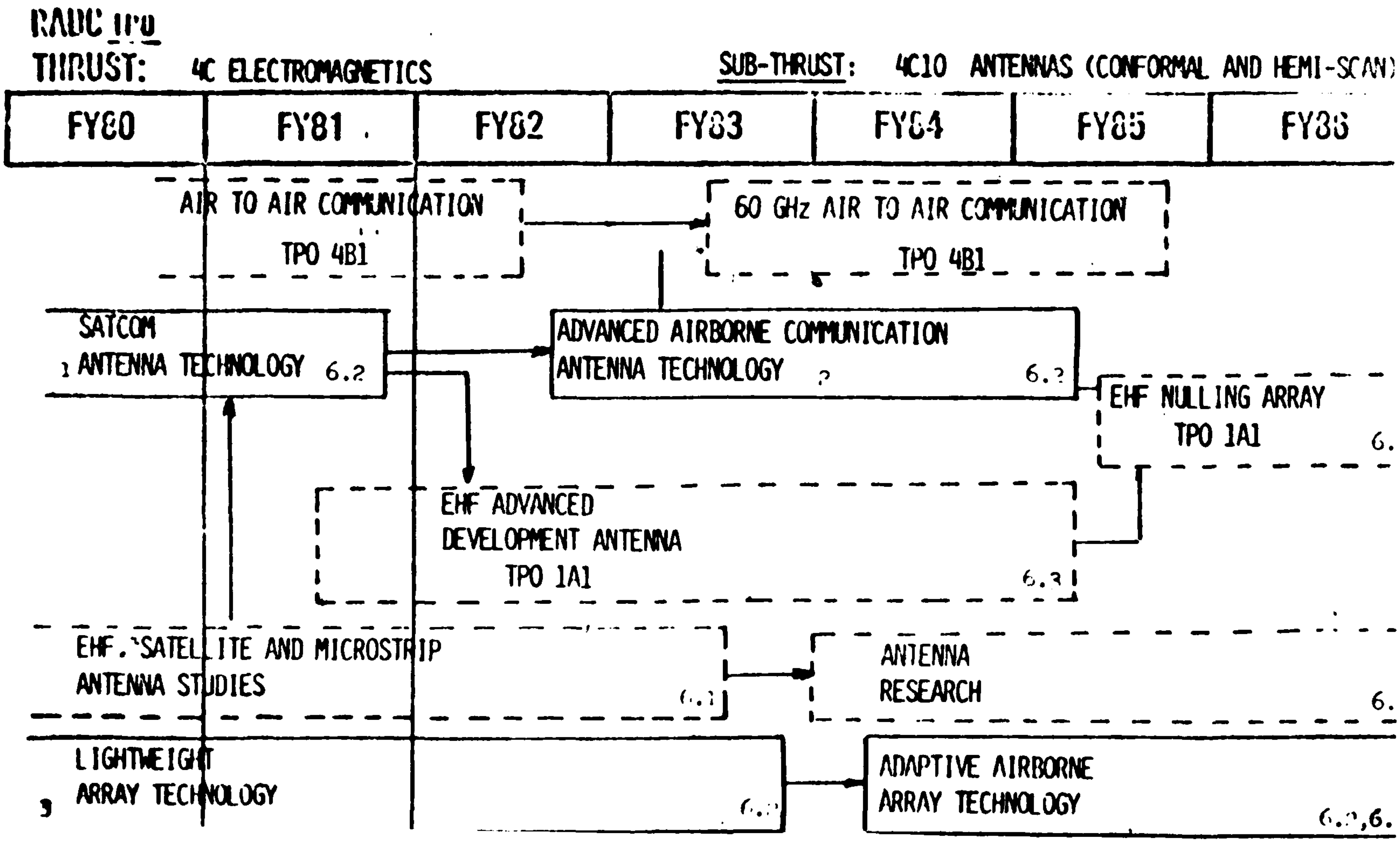
TITLE: DUAL BAND TACTICAL RADAR ANTENNA

OBJECTIVE: DEVELOP A C AND S - BAND ANTENNA WITH AN INDEPENDENTLY SCANNED BEAM FOR EACH FREQUENCY BAND. BANDWIDTH IS 10% AT EACH CENTER FREQUENCY.

APPROACH:

- GENERAL STUDY OF APPLICABLE DUAL BAND TACTICAL RADAR ANTENNA TECHNOLOGY.
- DESIGN PHASE WITH THREE SEPARATE APPROACHES
- SELECTION OF A WINNING APPROACH, COMPONENT AND ARRAY TEST.

PROPOSED EFFORT: OPEN - BID, 30 MOS, FY 81 - FY 83, ABOUT 3 MY.



RADC ITO
THRUST: 4C ELECTROMAGNETICS
SUB-THRUST: 4C10 ANTENNAS (CONFORMAL AND HEMI-SCAN)
FY80
FY81
FY82
FY83
FY84
FY85
FY86
AIR TO AIR COMMUNICATION
TPO 4B1
60 GHz AIR TO AIR COMMUNICATION
TPO 4B1
SATCOM
ANTENNA TECHNOLOGY 6.2
ADVANCED AIRBORNE COMMUNICATION
ANTENNA TECHNOLOGY
6.2
EHF NULLING ARRAY
TPO 1A1
6.
EHF ADVANCED
DEVELOPMENT ANTENNA
TPO 1A1
6.3
EHF SATELLITE AND MICROSTRIP
ANTENNA STUDIES
ANTENNA
RESEARCH
6.
LIGHTWEIGHT
ARRAY TECHNOLOGY
ADAPTIVE AIRBORNE
ARRAY TECHNOLOGY

SUB-THRUST: 1 ANTENNAS (CONFORMAL AND HEMISPHERICAL COVERAGE ANTENNAS)

BLOCK TITLE: SATCOM ANTENNA TECHNOLOGY

OBJECTIVE: DEVELOP LOW PROFILE, LIGHTWEIGHT ANTENNA TECHNOLOGY FOR AIRCRAFT COMMUNICATING WITH SATELLITES AT SHF AND EHF.

TECHNICAL APPROACH:

- LOW PROFILE FOUR FACED SHF ARRAY
- EHF ANTENNA TECHNOLOGY
  - HYBRID MECH/ELEC CONTROL
  - FULL ELECTRONIC CONTROL

PAYOFF: REPLACE PRESENT BULKY SHF AND EHF DISH ANTENNAS WITH CONFORMAL AND LOW PROFILE NEW TECHNOLOGY.

TITLE: EHF SATCOM TERMINAL ANTENNA

OBJECTIVE: DEVELOP A DUAL FREQUENCY, HYBRID MECHANICAL/ELECTRICAL SCAN ANTENNA FOR COMMAND POST TYPE AIRCRAFT.

APPROACH:

- ADVANCED DEVELOPMENT MODEL AT 20 GHz (Rx) AND 44 GHz (Tx) FOR C-135 AIRCRAFT
- LOW PROFILE, MINIMUM INTRUSION INTO FUSELAGE
- WIDE ANGLE UPPER HEMISPHERE COVERAGE

PROPOSED EFFORT: OPEN - BID, 2 YRS, FY 81 - 83

SUB-THRUST: 1 ANTENNAS (CONFORMAL AND HEMISPHERICAL COVERAGE ANTENNAS)

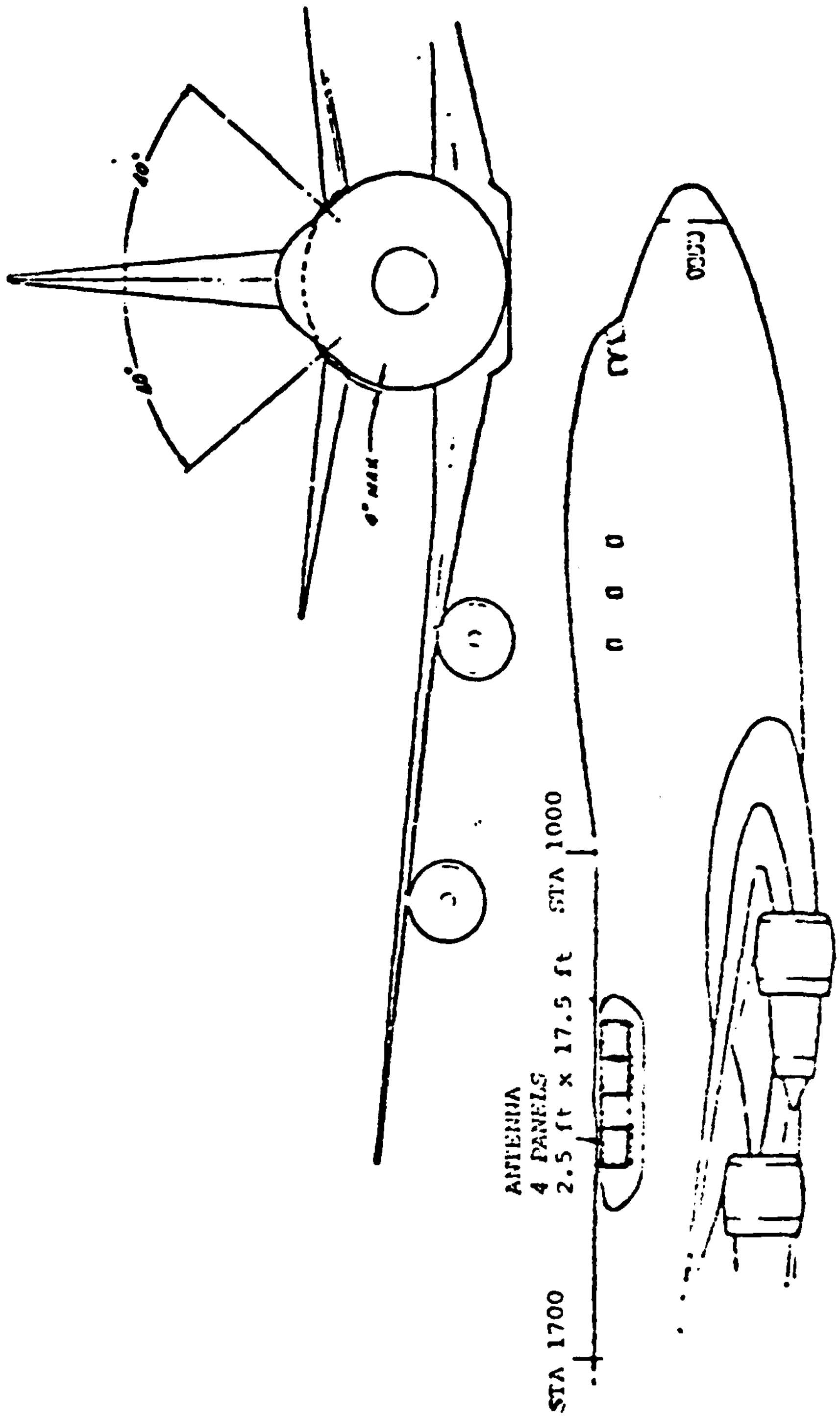
EFFORT BLOCK TITLE: LIGHTWEIGHT ARRAY TECHNOLOGY

OBJECTIVE: TO DEVELOP LIGHTWEIGHT HIGH PERFORMANCE ANTENNAS FOR AIRBORNE RADAR AND COMMUNICATIONS APPLICATIONS

TECHNICAL APPROACH:

- VERY HIGH GAIN PRINTED CIRCUIT ANTENNAS FOR SAC COMMUNICATIONS
- ADAPTIVE LOW SIDELOBE ARRAY FOR ADVANCED SURVEILLANCE RADAR

PAYOFF: LOW COST, LIGHTWEIGHT AIRCRAFT ARRAYS WOULD GREATLY INCREASE THE RANGE AND STATION TIME OF AIRBORNE SYSTEMS IN COMPARISON WITH ROTATING FIXED BEAM ANTENNAS


40°
40°
4° MAX
STA 1000
ANTENNA
4 PANELS
2.5 ft x 17.5 ft
STA 1700

TITLE: HIGH GAIN PRINTED CIRCUIT ANTENNAS FOR SAC COMMUNICATIONS

OBJECTIVE: DEVELOP ULTRA LOW LOSS PRINTED CIRCUIT ANTENNAS AT 2.25 GHz FOR AIRCRAFT USE.

APPROACH:

- INVESTIGATE LOSS REDUCTION METHODS FOR LARGE, HIGH GAIN, AIRBORNE PHASED ARRAY ANTENNAS
- ANALYZE EFFECTS OF INCORPORATING AMPLIFICATION AT THE ELEMENT OR SUB-ARRAY LEVEL
- CONSTRUCT AND DELIVER A TEST SECTION OF ARRAY

PROPOSED EFFORT: OPEN - BID, 2 YRS, FY 81 - 83, 4 MY.

TITLE: ADAPTIVE LOW SIDELOBE ARRAY FOR ADVANCED AIRBORNE SURVEILLANCE RADAR

OBJECTIVE: DEVELOP LIGHTWEIGHT, THIN PHASED ARRAYS FOR CONFORMAL MOUNTING ON AN AIRBORNE PLATFORM.

APPROACH:

- EXTREMELY LOW SIDELOBE LEVELS
- SELF - SURVEYING TECHNIQUES TO AUTOMATICALLY COMPENSATE FOR ELEMENT SHIFTS DUE TO AIRFRAME FLEXING
- NULL PLACEMENT, ADAPTIVE AND OPEN LOOP
- BROADBAND OPERATION

PROPOSED EFFORT: OPEN -BID, 2 YRS, FY 81 - 83, ABOUT 3 MY

SUB-THRUST: 1 ANTENNAS (CONFORMAL AND HEMISPHERICAL COVERAGE ANTENNAS)

BLOCK TITLE: ADVANCED AIRBORNE COMMUNICATIONS ANTENNA TECHNOLOGY

OBJECTIVE: DEVELOP LOW COST LIGHTWEIGHT CONFORMAL ARRAY TECHNOLOGY WITH ADVANCED ECCM FEATURES FOR SATELLITE COMMUNICATION

TECHNICAL APPROACH:

- EXTEND PRINTED CIRCUIT ARRAY TECHNOLOGY TO EHF FREQUENCIES
- INVESTIGATE USE OF ADVANCED MEANS OF NULLING, SIDELOBE CONTROL AND MULTIPLE FREQUENCY OPERATION.
- DEVELOP 60 GHz ANTENNA TECHNIQUES.

PAYOFF: SUBSTANTIAL INCREASE IN SATCOM AND AIR-AIR PERFORMANCE THROUGH WIDEBAND NULL STEERING AND MULTIPLE FREQUENCY FEEDS.

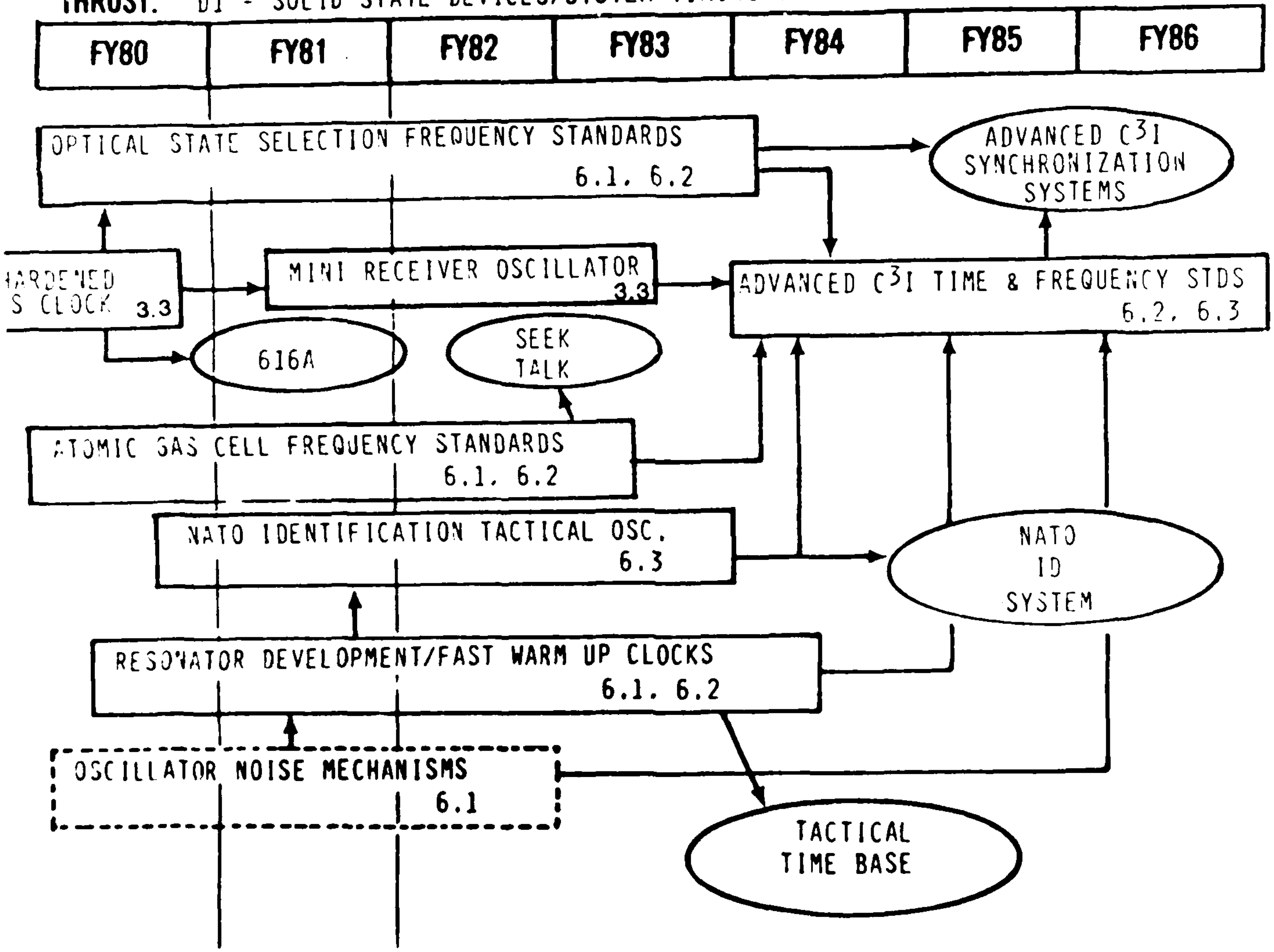
INDUSTRY LOOKS AT RADC

SYSTEM TIMING COMPONENTS

3 JUNE 1980
RADC-GRIFFISS AFB
DR. NICHOLAS F. YANNONI
(617) 861-3295

RADC TPO 4 - TECHNOLOGY

THRUST: D1 - SOLID STATE DEVICES/SYSTEM TIMING COMPONENTS



TASK AREAS

- QUARTZ OSCILLATOR RESEARCH
- ATOMIC FREQUENCY STANDARDS

FREQUENCY STANDARDS

- ATOMIC BEAM RESONATORS
- GAS CELLS
- MASERS
- CRYSTAL OSCILLATORS

TPO THRUST #/TITLE: 4D / SOLID STATE DEVICES

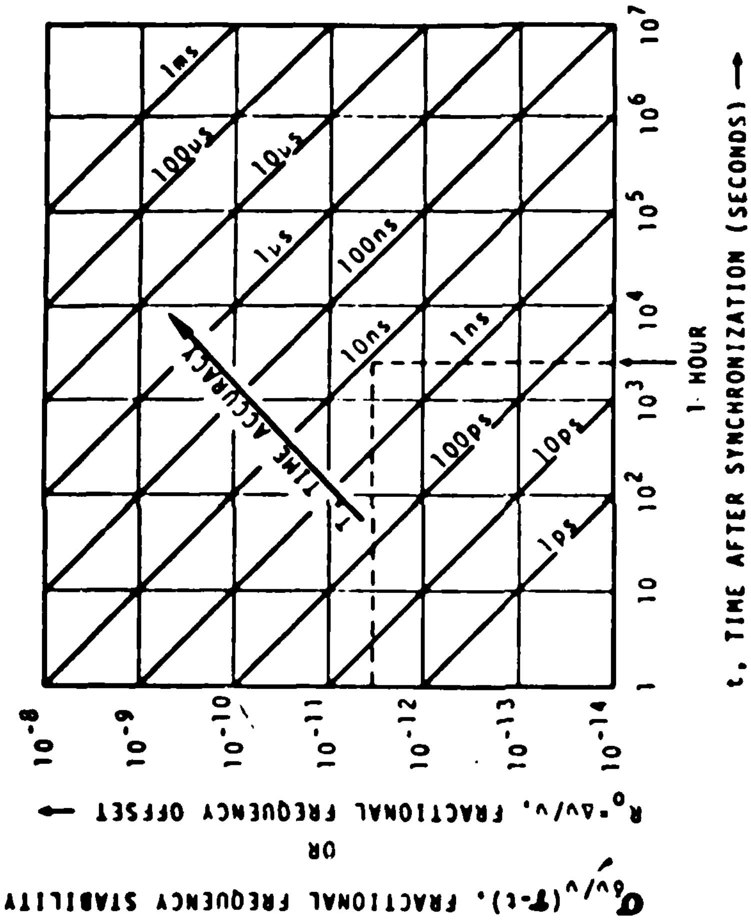
SUB-THRUST #/TITLE: 1 / SYSTEM TIMING COMPONENTS

MAJOR NON-DL PROGRAMS SUPPORTED

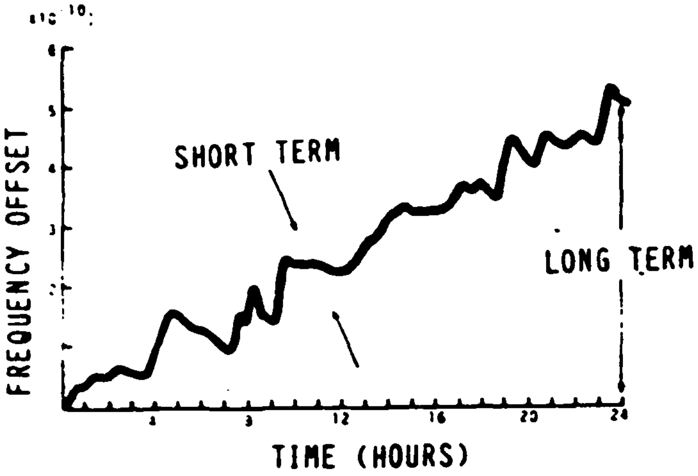
NON-DL PROGRAM	SUPPORT PROVIDED	CUSTOMER
616A/AF SUPPORT TO MEECN	DEVELOPMENT OF PORTABLE REAL-TIME CLOCK (CESIUM)	ESD
NIS/NATO IDENTIFICATION SYSTEM	TEST/EVALUATION OF CANDIDATE TIME BASE, QUARTZ OSCILLATOR DEVELOPMENT	ASD
SEEK TALK	DEVELOPMENT OF SMALL MILITARIZED RUBIDIUM STANDARD AND NEW DESIGN RUBIDIUM STANDARD	RADC/ESD

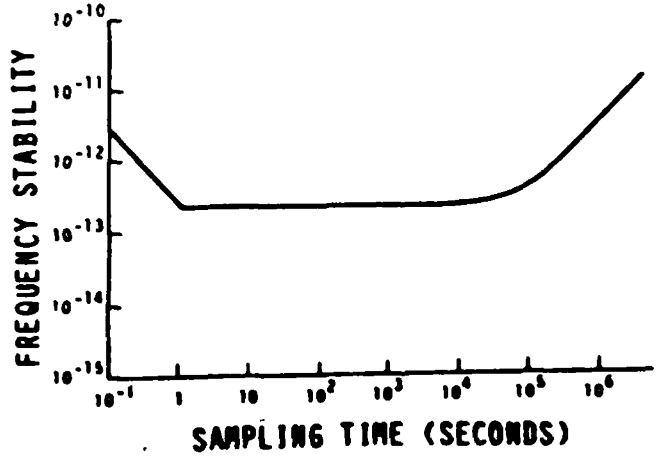
TIME AND FREQUENCY CHARACTERIZATION

- ACCURACY
- PRECISION
- STABILITY
  - SHORT-TERM
  - LONG-TERM


1ms
100μs
10μs
1μs
100ns
10ns
1ns
100ps
10ps
1ps
TIME ACCURACY
1 HOUR
1
10
10^2
10^3
10^4
10^5
10^6
10^7
t, TIME AFTER SYNCHRONIZATION (SECONDS)
10^{-8}
10^{-9}
10^{-10}
10^{-11}
10^{-12}
10^{-13}
10^{-14}
$R_o = \Delta\nu/\nu$, FRACTIONAL FREQUENCY OFFSET
OR
$\sigma_{\delta\nu/\nu}(2,\tau)$, FRACTIONAL FREQUENCY STABILITY

STABILITY CHARACTERIZATION





TIME/FREQUENCY DEVICE SELECTION CRITERIA

- PERFORMANCE
  - STABILITY, PHASE NOISE, ACCURACY
- SYSTEM LIMITATIONS
  - SIZE, WEIGHT, POWER
- COST
  - INITIAL AND/OR LIFE CYCLE
- OPERATIONAL REQUIREMENTS

MILITARY APPLICATIONS OF T/F STANDARDS

- NAVIGATION, POSITIONING, AND TARGETING
- COMMUNICATIONS
  - STRATEGIC
  - TACTICAL
  - SECURE AND ANTI-JAM
- SURVEILLANCE AND RECONNAISSANCE
- IDENTIFICATION
- INTELLIGENCE

PLATFORMS

- GROUND STATION - BENIGN ENVIRONMENT
- MOVING VEHICLE - TANK, HELICOPTER, TRUCK
  - POWER AVAILABLE
  - SEVERE ENVIRONMENTAL EFFECTS
  - RESYNCHRONIZATION PROBLEM
- HIGH PERFORMANCE AIRCRAFT
  - FAST WARMUP
  - SYNCHRONIZATION
- MANPACK
  - POWER/SIZE/WEIGHT
  - RESYNCHRONIZATION
- SATELLITE - Thermo -"ac.

OPERATIONAL REQUIREMENTS

- ENVIRONMENTAL SENSITIVITY
  - SPACE, NUCLEAR, ATMOSPHERE
- "ILITIES"
  - RELIABILITY, DURABILITY, MAINTAINABILITY, INTEROPERABILITY
- SHOCK, ACCELERATION, AND VIBRATION ON DIFFERENT PLATFORMS
- WARM UP AND TEMPERATURE FLUCTUATION
- EASE OF BATTLEFIELD DEPLOYMENT
  - MAN/MACHINE INTERFACES, SIMPLICITY, AUTOMATIC OPERATION

TIME/FREQUENCY STANDARDS PROGRAM ELEMENTS

MATERIAL	QUARTZ	PHYSICAL PROPERTIES
DEVICE	RESONATOR	Q-MEASUREMENTS
SUBSYSTEM	OSCILLATOR	FREQUENCY STABILITY SPECTRAL PURITY
SYSTEM	CLOCK	PERFORMANCE

RADC/ES T/F PROGRAM

TECHNOLOGIES

- o QUARTZ - MATERIALS; RESONATORS; OSCILLATORS
- o RUBIDIUM - SMALL MILITARIZED UNIT
- o CESIUM - PORTABLE REAL TIME CLOCK
- o HYDROGEN - SMALL LIGHTWEIGHT MASER
- o FREQUENCY/TIME TEST FACILITY

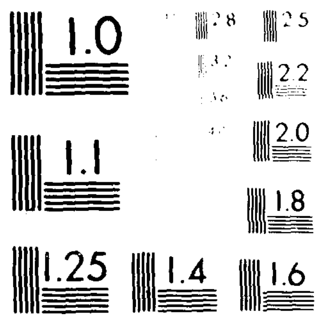
RADC/ES T/F PROGRAM

QUARTZ:

- o GROWTH
- o SWEEPING
- o ANALYSIS
- o SC CUT
- o BVA
- o OSCILLATORS FOR ABOVE
- o NOISE STUDIES

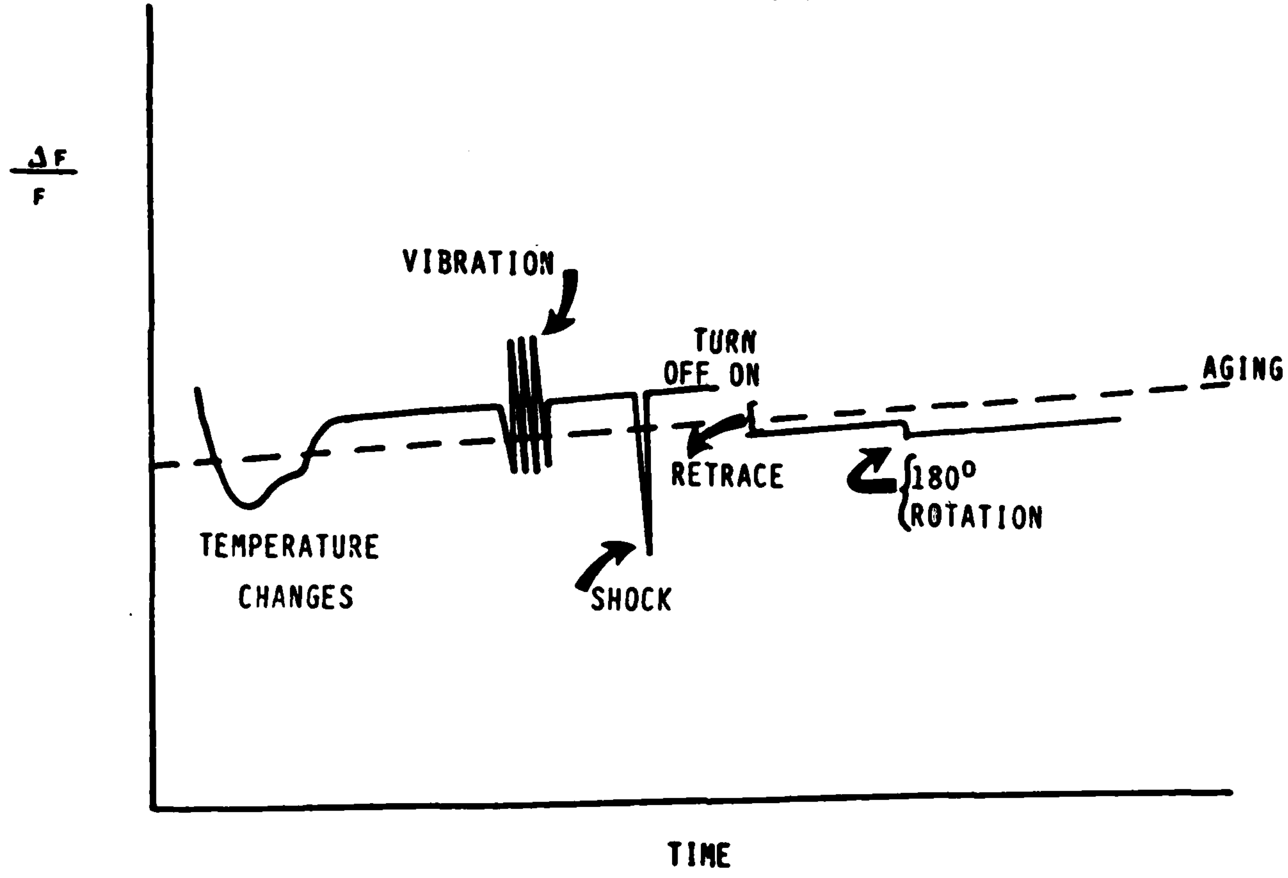
MATERIAL PROCESSING

- SWEEPING PARAMETERS
  - TEMPERATURE
  - VOLTAGE
  - ENVIRONMENT
  - DOPANTS
  - TIME
  - ELECTRODES
  - MULTIPLE SWEEPING
- IMPURITY PEAK IDENTIFICATION



MICROCOPY RESOLUTION TEST CHART

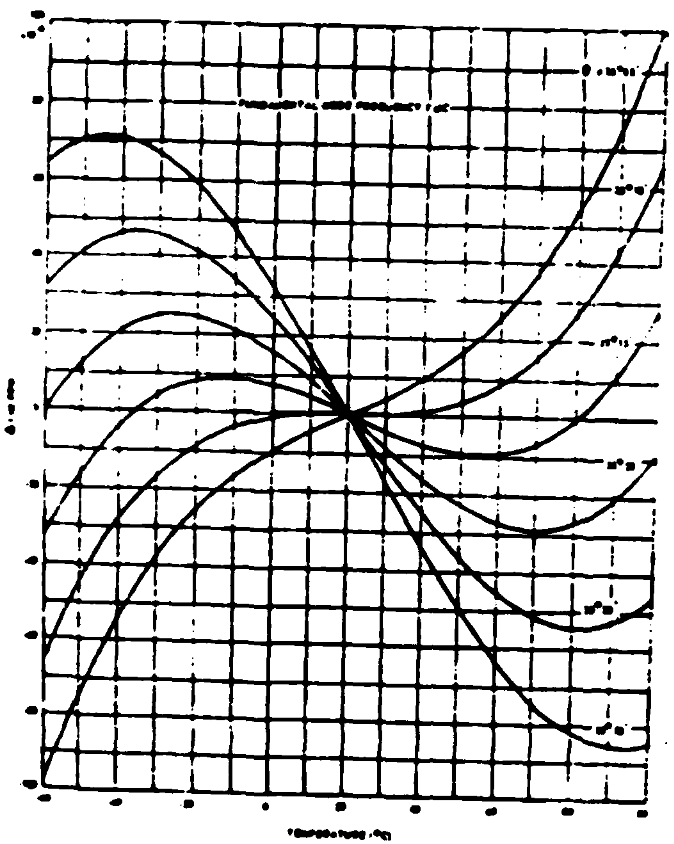
ENVIRONMENTAL EFFECTS ON
QUARTZ OSCILLATORS



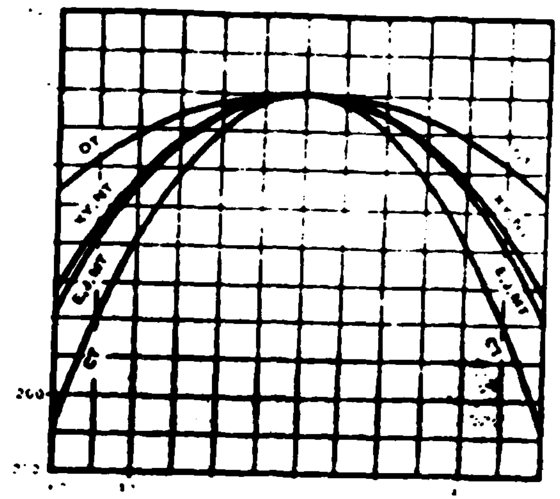
ENVIRONMENTAL EFFECTS

- CRYSTAL — ATOMIC REARRANGEMENT
- RESONATOR — ANELASTIC LOSSES
- OSCILLATOR —
  1. CESSATION OF OSCILLATION
  2. FREQUENCY OFFSET
     - A. TRANSIENT
     - B. PERMANENT

FREQUENCY - TEMPERATURE CHARACTERISTICS

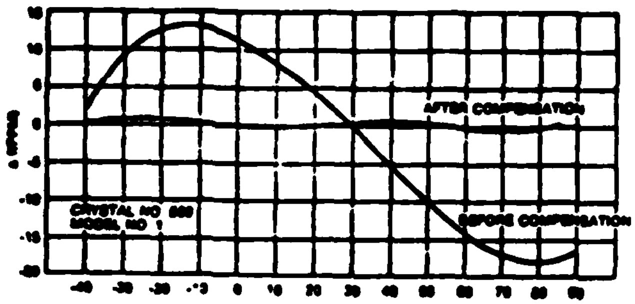


Frequency-temperature-angle characteristics of plated AT-type natural quartz crystal resonators.[4]

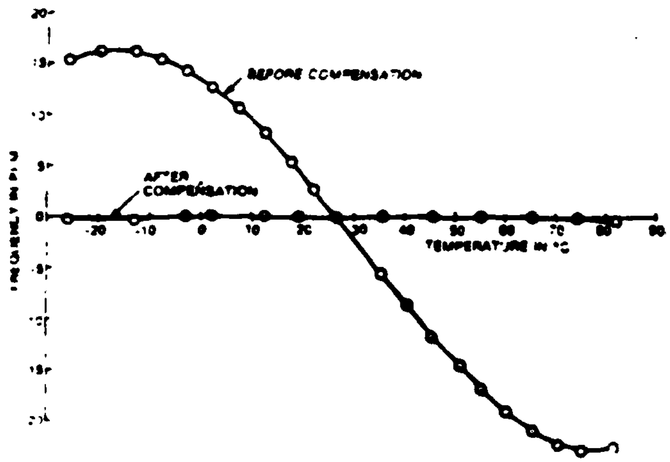


Frequency-temperature characteristics of low frequency crystal cuts (Courtesy Northern Engineering Laboratories)

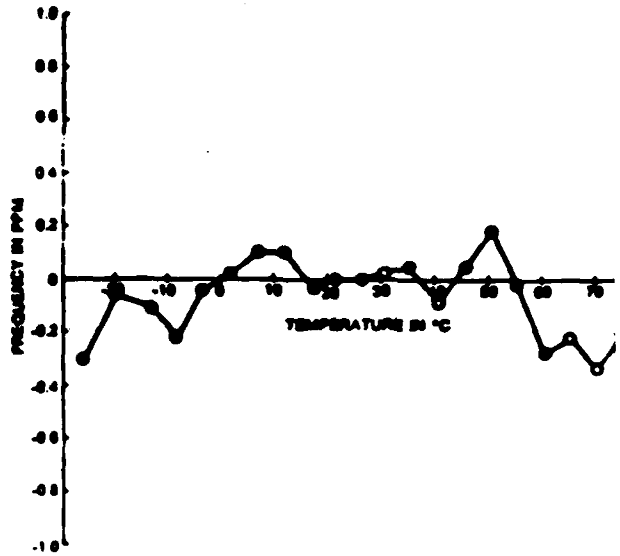
TEMPERATURE COMPENSATION CURVES



Frequency versus temperature characteristic for a typical temperature-compensated crystal oscillator.



Frequency-Temperature for microprocessor compensated crystal oscillator



Frequency-Temperature for microprocessor compensated oscillator (expanded scale)

Warm-up Time vs Warm-up Power: SC & BT Cuts

Warmup from still air ambient of 25°C
Warmup to within ±5 x 10^{-9} of 12 hour value

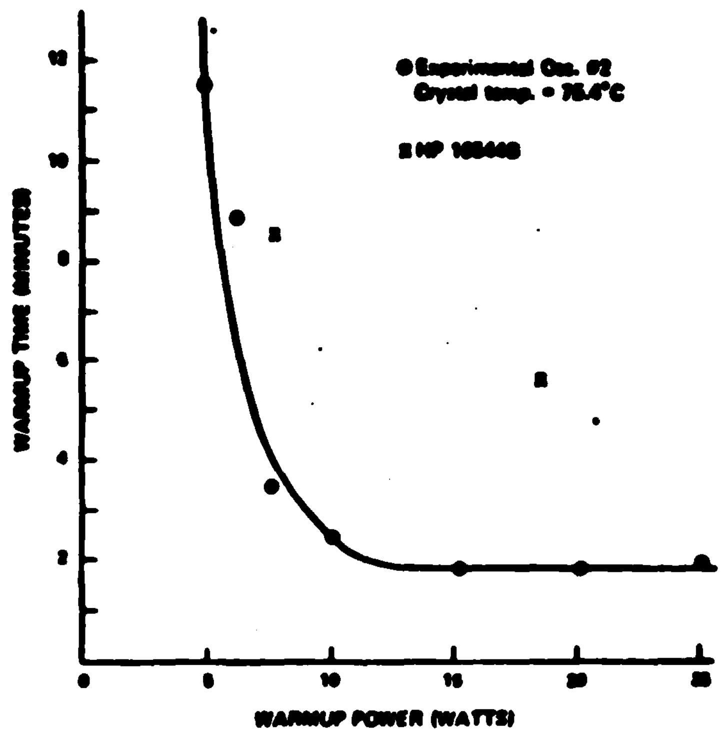
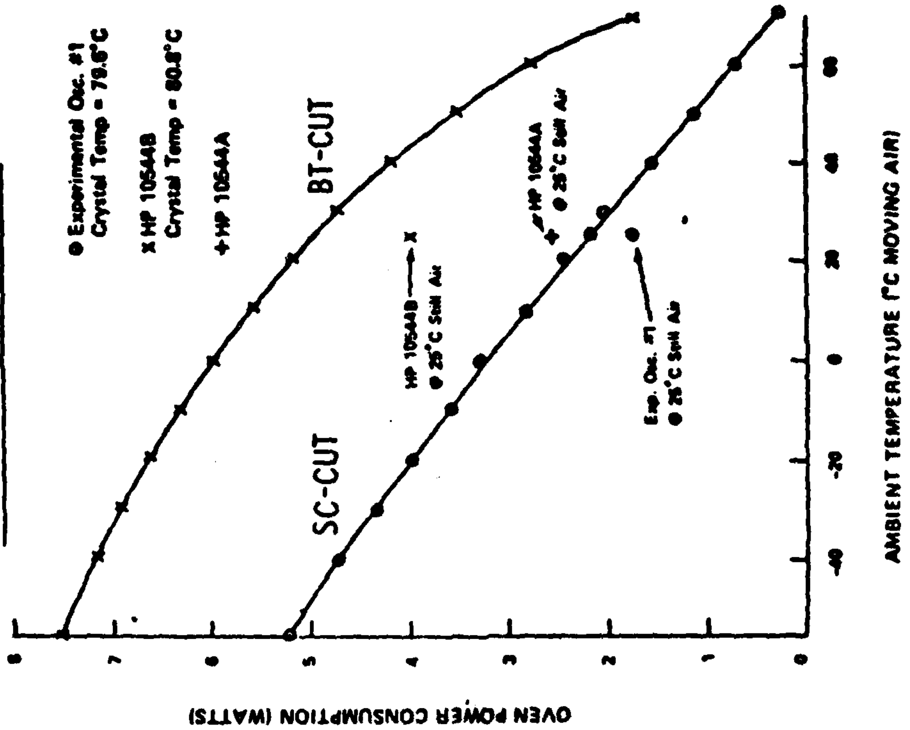
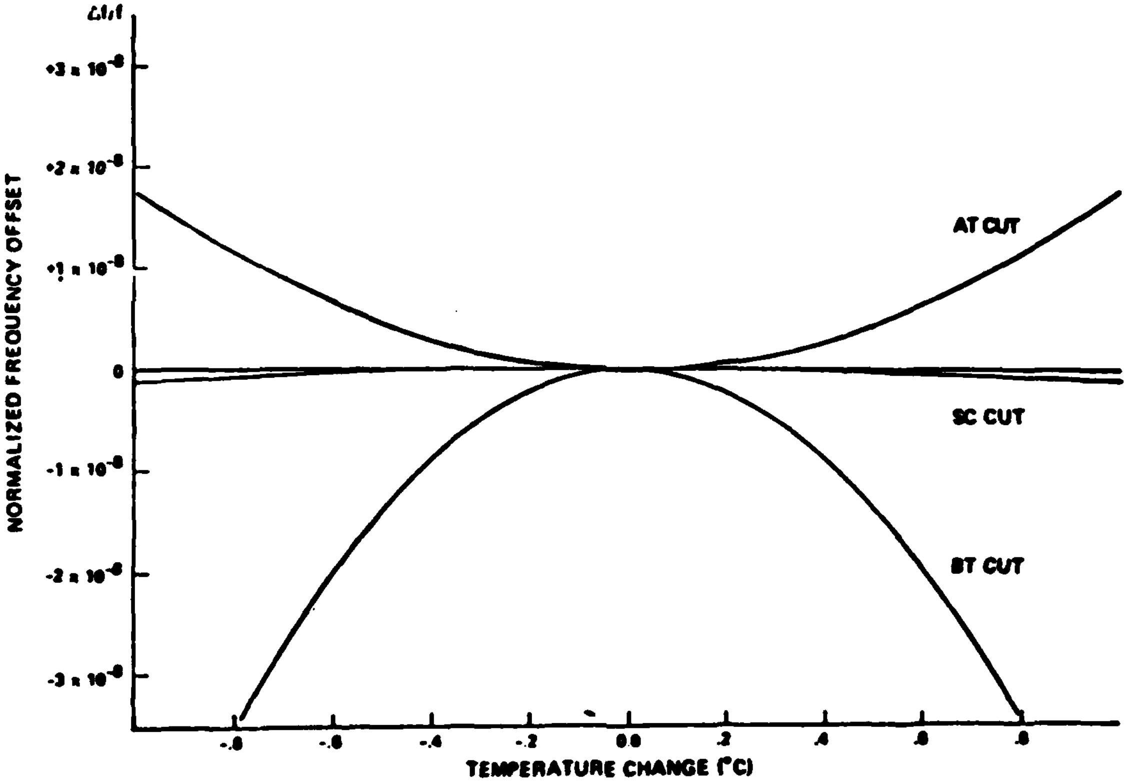


Figure 1. Warmup Time vs Warmup Power for Experimental Oscillator #2

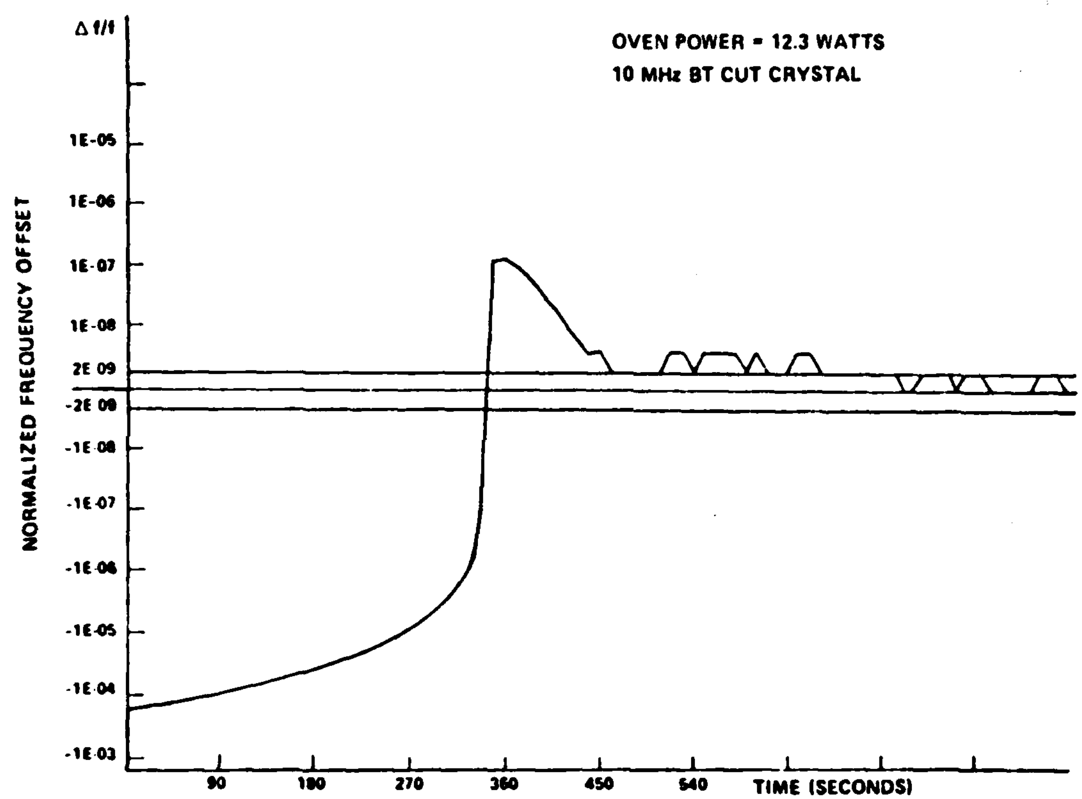
STEADY-STATE OVEN POWER CONSUMPTION VS AMBIENT TEMPERATURE



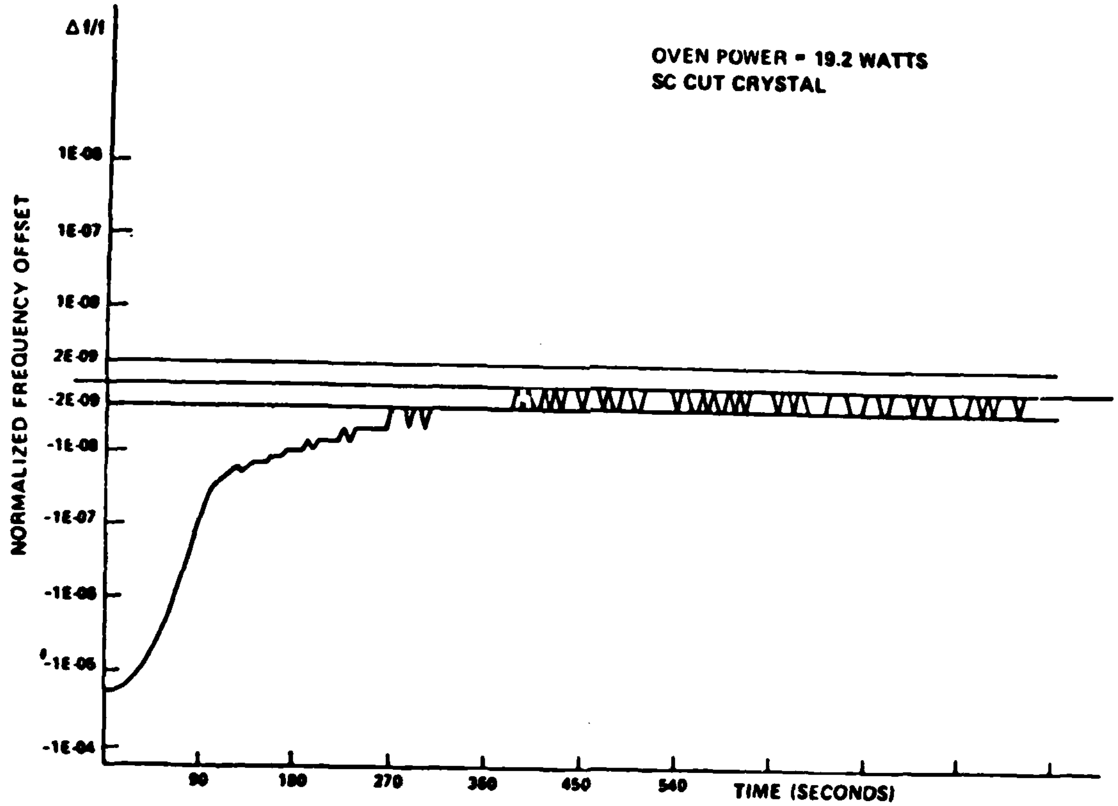
FREQUENCY CHANGE VS. TEMPERATURE NEAR THE TURNOVER



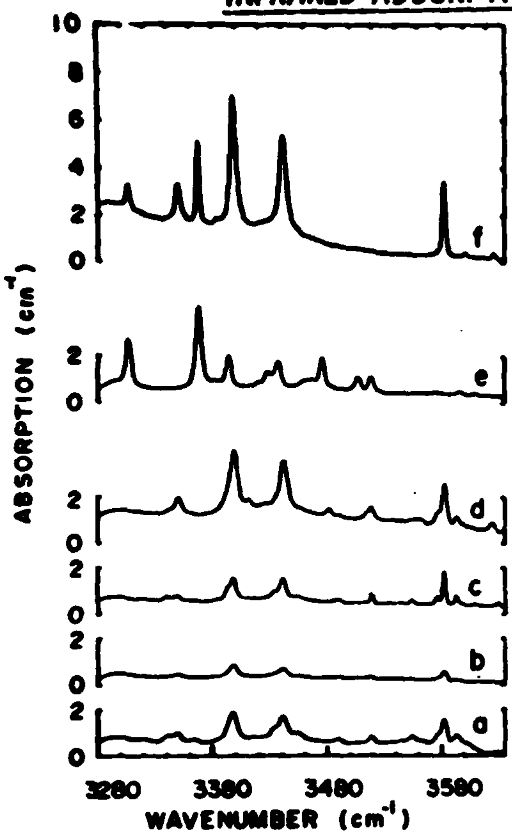
OSCILLATOR WARMUP WITH BT-CUT CRYSTAL



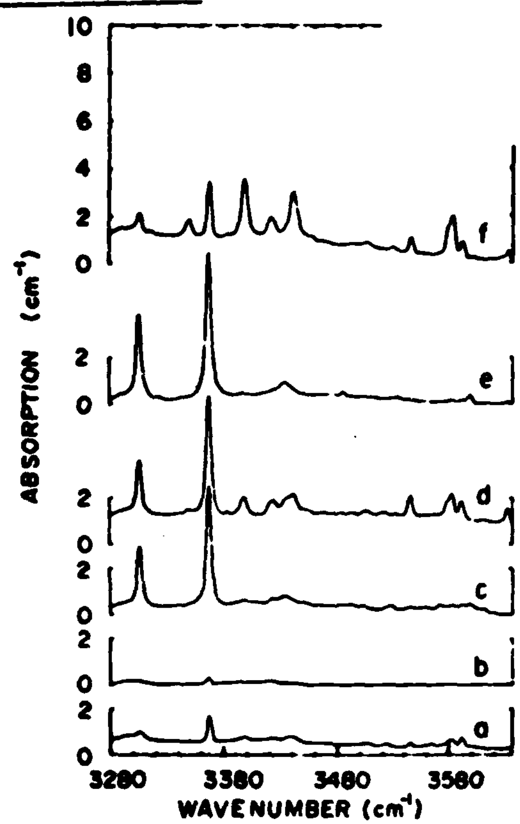
OSCILLATOR WARMUP WITH AN SC-CUT CRYSTAL



INFRARED ABSORPTION SPECTRA OF QUARTZ

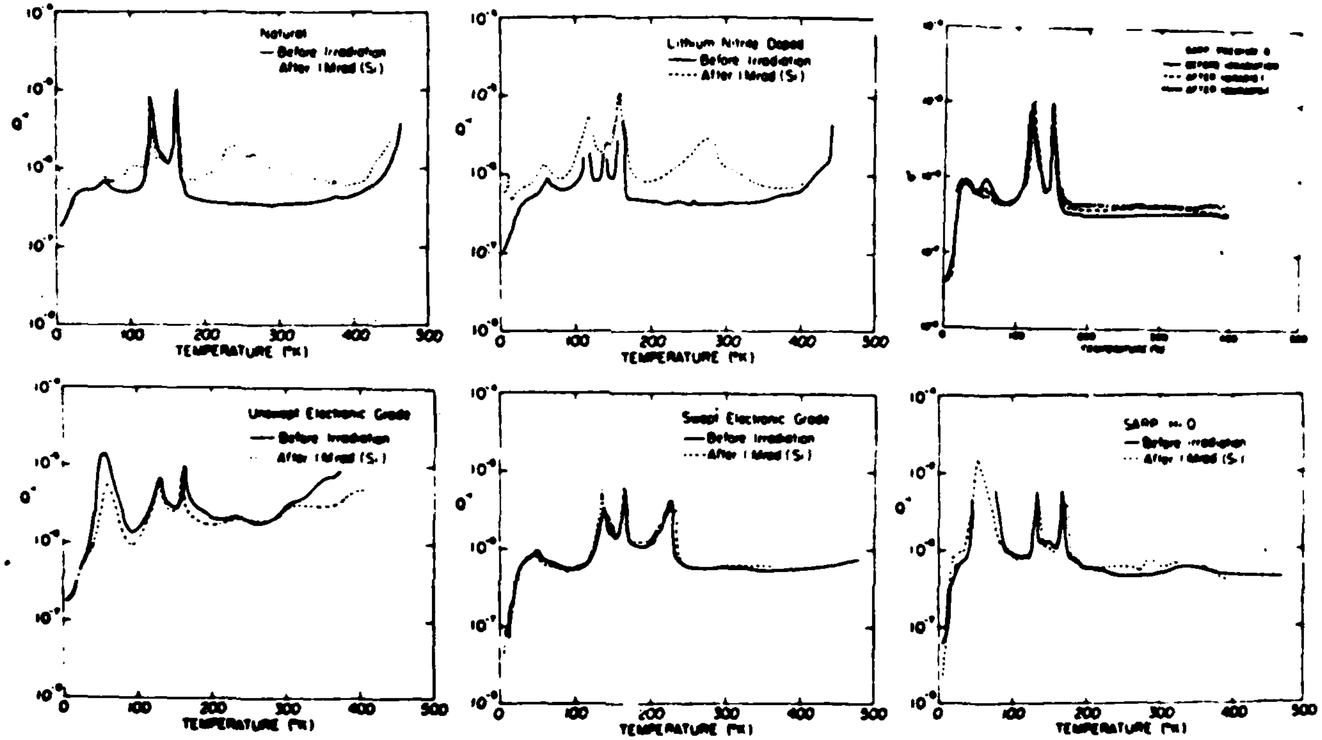


E⊥C ABSORPTION SPECTRA AT 12°K.
(a) HIGH-Q (b) PREMIUM-Q
(c) ELECTRONIC GRADE (d) Li-DOPED
(e) NATURAL (f) SWEPT ELECTRONIC



ABSORPTION SPECTRA AT 12°K AFTER A DOSE OF 6700 MRad OF 10 MeV ELECTRONS

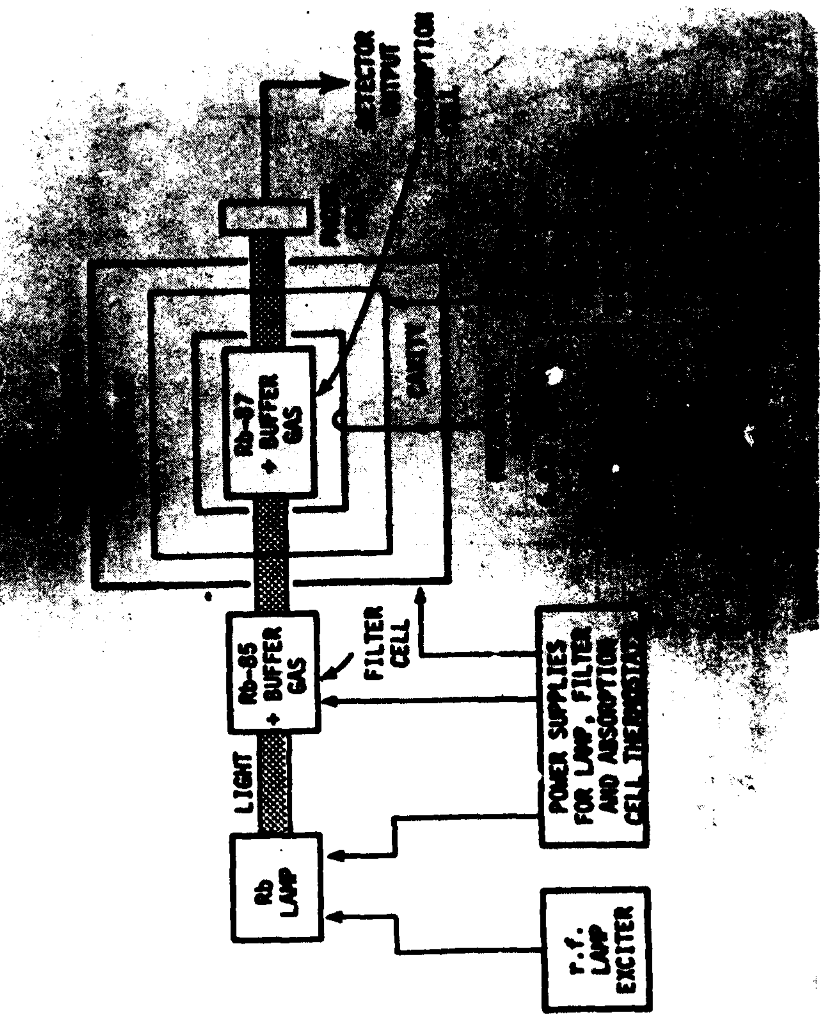
ANELASTIC LOSS Q^{-1} VS TEMPERATURE



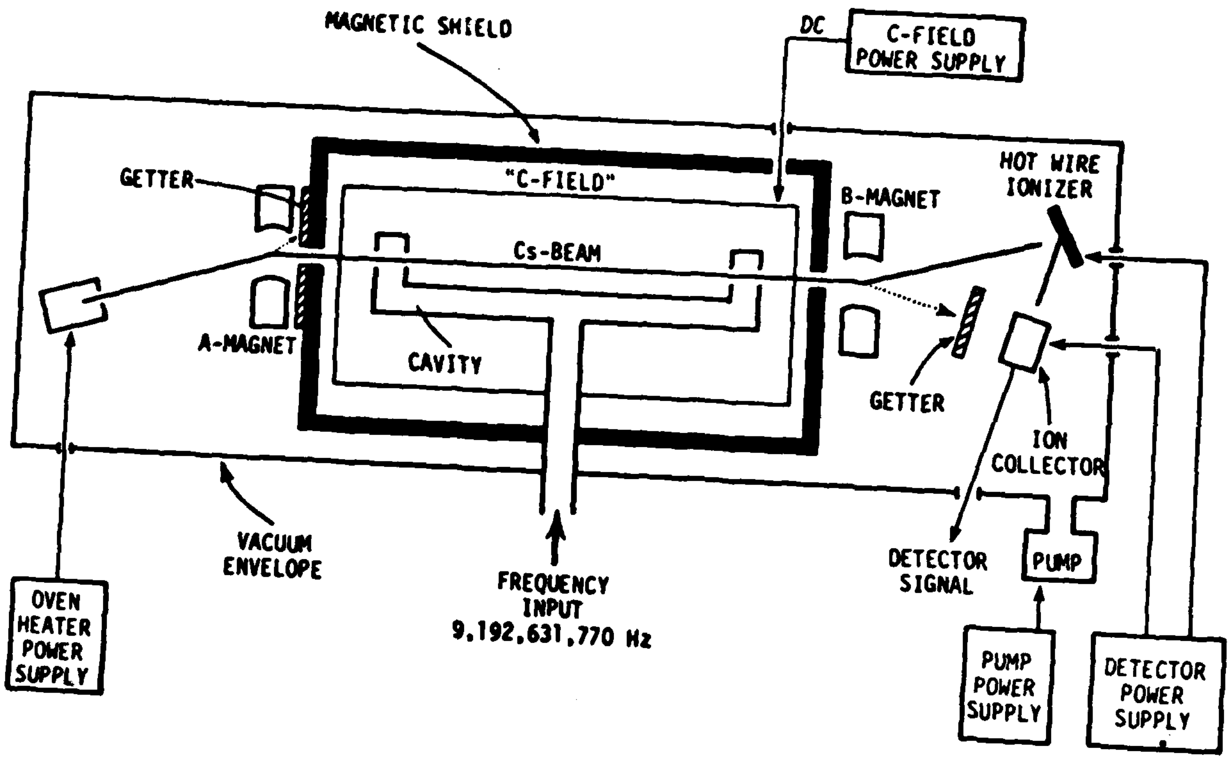
NEW/IMPROVING TECHNOLOGIES

- O SC-CUT
- O BVA DESIGN
- O QUARTZ GROWTH AND SWEEPING
- O LOW TEMPERATURE STUDIES
- O BETTER THEORETICAL UNDERSTANDING
- O FABRICATION/PROCESSING
    - SURFACE CLEANING AND POLISHING
    - ULTRA-PURE (HI-VAC) FABRICATION
    - AUTOMATION OF SC-CUTS

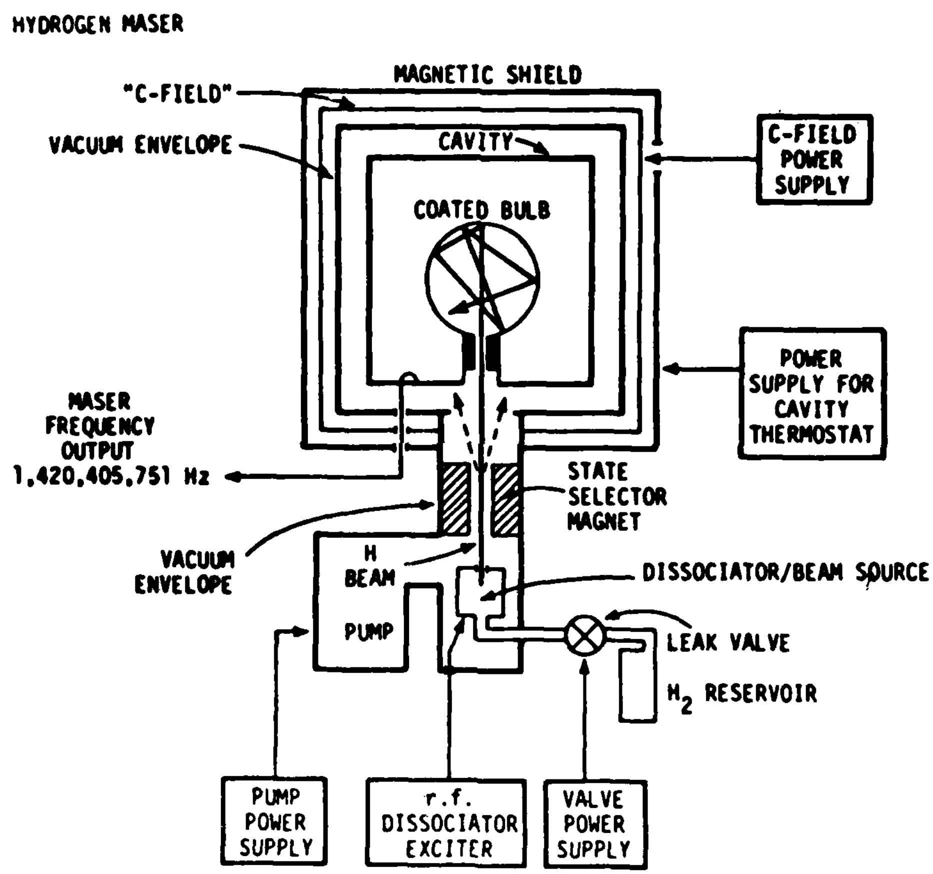
RUBIDIUM ATOMIC RESONATOR



CESIUM ATOMIC RESONATOR



Schematic of a cesium beam tube. *Typically*, a cavity with separated interrogation regions is used. This design offers certain advantages over a simple cavity of a length equivalent to the separation of the two regions. See Appendix II.



Schematic of a hydrogen maser oscillator.

SUPPLIERS OF STANDARDS AND CLOCKS

QUARTZ OSCILLATORS: HP*, FEI, FTS, A AND OTHERS.

RUBIDIUM: HP, E, T

CESIUM: HP, FEI, FTS

HYDROGEN: NO CCMMERCIAL VENDORS

WESTERN EUROPE:

OSCILLOQUARTZ (SWITZERLAND)

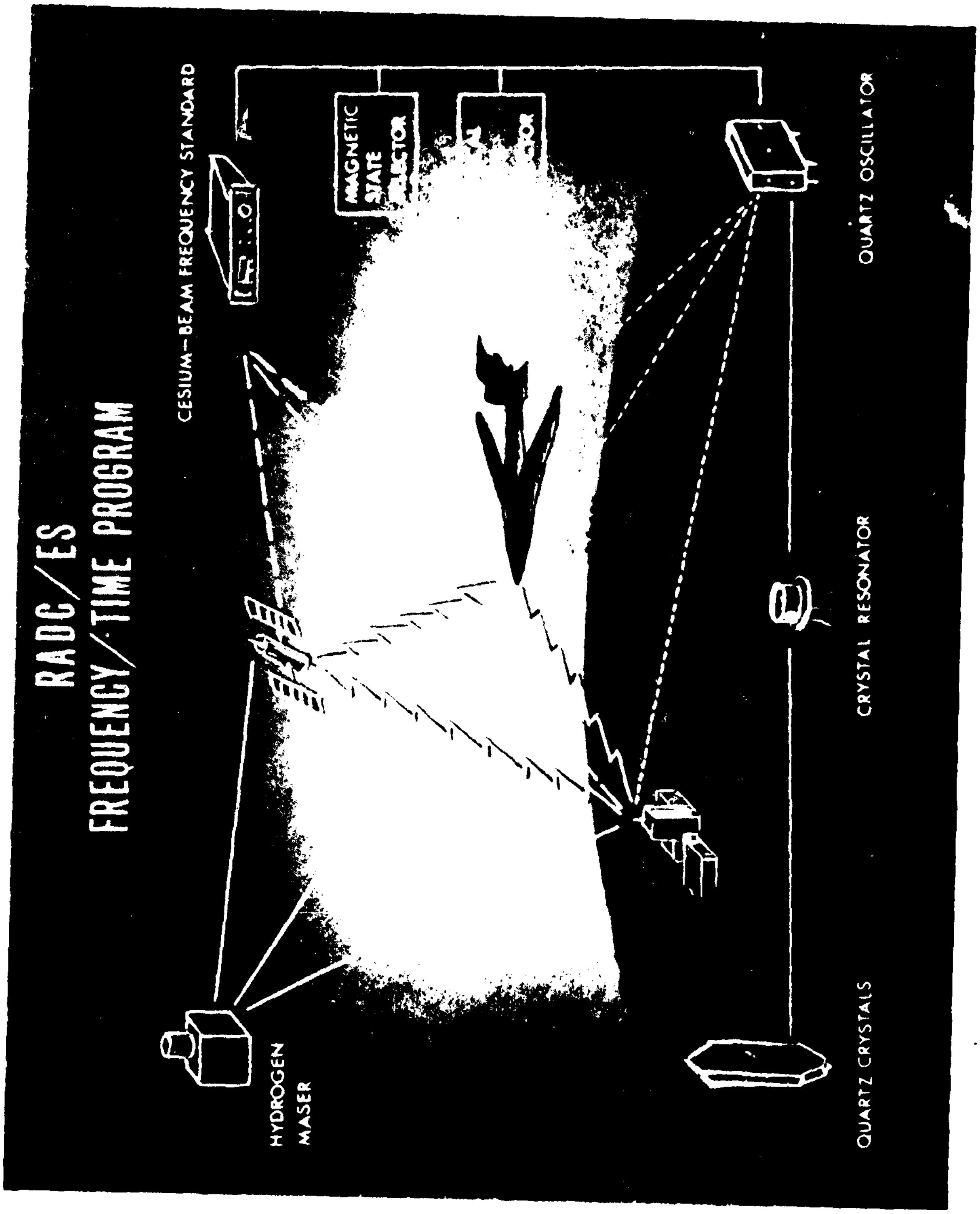
Q. & E. (FRANCE)

C. E. P. E. (FRANCE)

ROHDE & SCHWARTZ (W. GERMANY) & EFRATOM

PLESSEY, RACAL, CATHODEON (U. K.)

* HP: HEWLETT-PACKARD
FEI: FREQUENCY ELECTRONICS, INC.
FTS: FREQUENCY & TIME SYSTEMS
E: ETRATOM
A: AUSTRON
T: TRACOR


RADC/ES
FREQUENCY/TIME PROGRAM
CESIUM-BEAM FREQUENCY STANDARD
MAGNETIC
STATE
HYDROGEN
MASER
QUARTZ OSCILLATOR
CRYSTAL RESONATOR
QUARTZ CRYSTALS

MISSION
of
Rome Air Development Center

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